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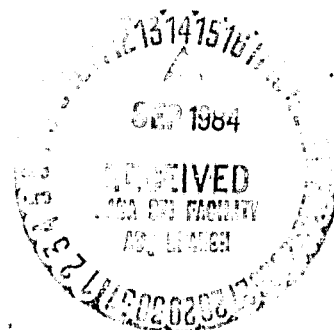
84-10184) SPECTRAL CHARACTERIZATION OF
THE LANDSAT THEMATIC MAPPER SENSORS (NASA)
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SPECTRAL CHARACTERIZATION OF THE LANDSAT THEMATIC MAPPER SENSORS

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SPECTRAL CHARACTERIZATION OF THE LANDSAT THEMATIC MAPPER SENSORS

INTRODUCTION

The intent of this document is to provide a summary of the information obtained on the spectral characteristics of the two Thematic Mapper (TM) instruments built and tested by Hughes Aircraft Company for the NASA Landsat Program. The first of these two units, the protoflight (TM/PF) model, was integrated into the Landsat-4 satellite, which was launched on 16 July, 1982. The second, the flight (TM/F) unit, has been integrated into the Landsat-4 backup spacecraft, which is scheduled for possible launch in 1985.

Each Thematic Mapper has seven spectral bands. These bands, with their nominal bandpasses, are:

1. Blue-green, 450 nm to 520 nm.
2. Green, 520 nm to 600 nm.
3. Red, 630 nm to 690 nm.
4. Near-IR, 760 nm to 900 nm.
5. Mid-IR 1, 1550 nm to 1750 nm.
6. Thermal-IR, 10.4 μ m to 12.5 μ m.
7. Mid-IR 2, 2080 nm to 2350 nm.

Each reflective band consists of an array of 16 channels; the thermal band consists of four channels. Although there are multiple detectors per band, there is only one filter per band (covering all detectors). This design differs from the MSS where each channel has both an individual detector and

filter. The first four bands are located at the primary focal plane of the TM, which is uncooled, and all use monolithic silicon detectors. Bands 5 through 7 are located on the cooled focal plane, which operates at 90°K-105°K. Bands 5 and 7 use monolithic InSb detectors; band 6 uses photoconductive HgCdTe detectors.

NASA placed two sets of specifications related to spectral performance on the instrument. One set of specifications concerned the spectral coverage of the bands. The specifications were on the following parameters (Fig. 1):

1. Lower and upper-band edges--points at 50% of peak relative spectral response (RSR).
2. Lower and upper-edge slopes--widths between specified percentages of maximum spectral response.
3. Spectral flatness--percentage of bandpass within given percentage (10% for reflective bands, 20% for thermal band) of peak response, after dividing out detector slope for silicon detectors.
4. Spurious system response--percentage of response outside 5% RSR points relative to response inside 50% points for solar equivalent input.

The second set of specifications concerned the spectral matching of the channels within each of the reflective bands. It stated that when all channels within a band are calibrated to produce equivalent outputs when viewing the specified flat scene radiances, the maximum difference in output between channels when all are viewing the specified spectrally sloping scene shall be less than 0.5 percent of the minimum saturation level (Fig. 2).

Hughes developed separate tests to determine compliance with the spectral coverage and spectral matching specifications. In addition, other tests conducted on the TM instruments revealed spectrally related information. Time and program constraints limited the number and detail of the spectral tests conducted, and in general, less spectral data was collected on the TM instruments than on the MSS sensors (Markham and Barker, 1982).

SPECTRAL COVERAGE

Procedures

The primary spectral coverage test* was based on analyses of spectral measurements on the components contributing to the spectral response: filters, detectors and optical surfaces. The overall spectral response for a TM channel was defined as:

$$RSR_{Ai}(\lambda) = \frac{TOA(\lambda) * TFA(\lambda) * RA_i(\lambda)}{KA_i} \quad (1)$$

*Hughes Aircraft Company, Santa Barbara Research Center, "TM System Spectral Response," internal memorandum HS236-7213, Jan. 13, 1981; "F-1 TM System Relative Spectral Response," internal memorandum HS236-8162, Nov. 9, 1982.

Where:

$RSR_{Ai}(\lambda)$ = normalized relative spectral response in band A, channel i (percent).

$TOA(\lambda)$ = spectral throughput of the optical system in band A (percent).

$T_{FA}(\lambda)$ = spectral transmission of the filters in band A (percent).

$RA_i(\lambda)$ = relative spectral response of detector i for band A (percent).

KA_i = the normalization factor to bring the peak overall band A, channel i response to 100%.

By measuring the component responses and then calculating the overall spectral response, determination of compliance with the spectral coverage specifications could be facilitated without tying up the TM instrument for the test. Note that the filter and optical responses were band specific, whereas the detector response was channel specific.

The optical system for bands 1-4 consists of five mirror surfaces: the scan mirror, the primary and secondary telescope mirrors and the two mirrors of the scan line corrector (Fig. 3). Bands 5-7 have two additional mirror surfaces and two windows: the relay spherical and folding mirrors and the ambient and dewar windows. The optical components' transmittances and reflectances were measured with a spectrophotometer. Measurements of mirror reflectance were taken on witness samples which were coated concurrently with each mirror. Reflectance measurements were taken at an angle corresponding to use within the system, that is, normal incidence for all but the scan and scan line corrector mirrors, which were measured at a 45 degree angle. Window transmittances were measured on the actual flight parts at a normal angle of incidence. The products of the appropriate set of measurements were used as the optical spectral throughputs for the individual bands.

Each TM band has one filter for all channels within the band (Fig. 4). The small size of each filter made measuring its spectral transmittance difficult, so measurements made on the filter material prior to sizing were used in the calculations of RSR. Filter materials for bands 1-5, 7 were measured at nominal operating temperature. Band 6 filter material could not be measured at operating temperature (90°K-105°K) prior to sizing, and was therefore measured at ambient temperature. Measurements on a piece of witness filter material at ambient and at 90°K were used to determine a factor for converting ambient measurements to 90°K conditions. Both the TM/PF and TM/F used filters cut from the same pieces of filter material, therefore identical filter transmission data were used for both calculations of RSR.

Each TM has 16 silicon photodiode detectors for each of bands 1-4, 16 InSb detectors for bands 5 and 7 and four HgCdTe detectors for band 6 (Fig. 4). The relative spectral responses of three of the TM/PF detectors per band were measured for bands 1-4. Differences between the three detector measurements were deemed to be smaller than the measurement errors, so the

average of the three was used to represent all 16 detectors of the TM/PF. As the detector spectral response should theoretically be smooth, a best-fit curve through the averaged measured responses was used in the calculations of RSR. The TM/PF measurements were also used to represent the TM/F detectors as all detector arrays were from the same batch. For bands 5 and 7, one element of "sister" arrays (manufactured from the same wafer as the actual parts) were measured, as the actual parts could not be measured directly. These measurements were used to represent all 16 detectors for both the TM/PF and TM/F. For band 6 in the TM/PF all four detectors were measured and were individually used to make channel-by-channel calculations of RSR. For the TM/F, the odd (1 and 3) channels were similar and the even (2 and 4) channels were similar, and only two calculations were made for band 6.

Thus, with the exception of band 6, RSR's for the TM units were calculated on a band-by-band basis. In addition, again excluding band 6, the same numbers were used for the TM/F as for the TM/PF for the filter and detector responses. In the reflective bands only the differences in the optical surfaces between TM/PF and TM/F affected the calculated RSR's. In band 6, RSR was calculated on a channel-by-channel basis for the TM/PF and with one calculation for the even channels and one for the odd channels for the TM/F.

The one spectral coverage specification not addressed by the RSR calculation was spurious system response. The spurious system response, a measure of out-of-band response, is the integrated response outside the 5% response points relative to inside the 50% response points for solar equivalent input. What was typically used to determine compliance with this specification was the filter vendor's (Optical Coating Laboratory, Inc.) calculations of the integrated spurious filter transmission--with the integration being performed across the nominal range of sensitivity for the detectors, but not considering the detector's response or solar irradiance. For bands 4 and 6, the nominal detector responses and solar irradiances were considered in the calculation and these should give more accurate representations of true out-of-band response.

A limited empirical determination of out-of-band response was also conducted on the TM/F.* Peak responses of the primary focal plane bands to scans of a slit of light passed separately through witness filter pieces of the other bands were recorded.

Results

The results of the RSR calculations are presented in Figures 5-11, along with a comparison of the spectral performance to specifications. In Appendix A the RSR data for TM/PF and TM/F are tabulated (Tables A1-A7). For the reflective bands (1-5, 7) performance was within specifications and near nominal with the following exceptions:

1. Bands 2 and 3 flatnesses were slightly below specifications (<5%), and band 7 flatness was below specifications.

*Hughes Aircraft Company, SBRC, "Light Leaks in the Prime Focal Plane Assembly-II," internal memorandum HS236-8163, November 19, 1982.

2. Band 5 upper-band edge was higher than specifications: 1730-1770 nm specified, 1784 nm actual.

3. Band 2 band edges were shifted upward about 9 nm relative to nominal.

4. Band 4, 5 and 7 lower-band edges were 16-18 nm higher than nominal.

The band 5 out-of-specification upper-band edge resulted in the inclusion of a portion of the spectrum affected by atmospheric water absorption. This could contribute to increased sensitivity of the band to atmospheric water content variability. The other variations from specifications are not expected to produce significant data utility impacts. In bands 1-5 and 7 the TM/PF and TM/F responses were similar, with the only differences being apparent in the within-band shape. The differences in within-band shape were due to the only differences in the numbers input to the RSR calculations: optics.

In band 6, the TM/PF and TM/F showed fundamentally different spectral responses. The TM/PF upper-band edge was detector determined at a temperature dependent value of about 11.7 μm ; the TM/F upper-band edge was filter determined at 12.43 μm . The TM/PF band 6 was out of specification in terms of the upper band edge, upper-edge slope and flatness. The TM/F band 6 was within specification except for the lower-edge slope which was slightly wide. The principal reason for the 10.4 μm to 12.5 μm bandwidth specification on band 6 was to allow sufficient signal to achieve the 0.5% radiometric sensitivity requirement. As the TM/PF scanner's band 6 radiometric response was significantly better than specified, the failure to meet the spectral specification was not critical.

The calculated out-of-band responses suggest that all bands are within specifications (Table 1). In most bands the spurious response is simply an indication as to how rapidly the RSR rises from 0% to 5% and drops from 5% to 0%. The bands in general do not contain significant response peaks away from the primary response region. In band 1 there are two minor transmission "peaks" at 800 and 885nm with magnitudes of 0.5% and 0.7%, respectively (Fig. 12). In band 3 there is some transmission in the 950-1100nm range, reaching a peak transmittance of 3% at about 955nm (Fig. 13).

In the empirical test of spurious system response each band gave the highest output to light externally filtered through a piece of its filter material, as expected (Table 2). Also adjacent bands showed some spectral "crosstalk" as their spectral responses overlapped. The only noteworthy out-of-band response occurred in band 1. Band 1 gave a 1.2 count response for a radiance passing through a band 4 filter that produced 115 counts in band 4. This indicates that the two small peaks in the filter transmission of band 1 in the band 4 region result in a 1 count response in band 1 for about every 100 counts in band 4. A comparable impact on band 4 output filtered by a band 1 filter material was not obtained due to the lower gain setting in band 4 and the higher response of silicon in the band 4 region. Note that the impact of the band 3 response at 950-1100 nm was not evaluated in this test as no TM band covered this spectral region. The impact of the band 3 response at 950-1100 nm would be less than the filter transmission indicates, as the relative response of the silicon detectors drops rapidly with increasing wavelength in this region. At 950 nm it is

down to about 50% of its peak response at 850 nm and dropping rapidly.

SPECTRAL MATCHING

TM/PF Procedures*

The spectral matching test designed for the TM/PF scanner made use of instrumentation configurations already planned for other tests and data from existing tests, thereby limiting the impact on program scheduling. First, each channel of the TM/PF scanner was calibrated on a 1.22 m integrating sphere of known spectral radiance (Fig. 14). This test, conducted 29-30 June 1981, was a standard calibration test and provided the gains and offsets for each channel. Then on 8-11 July 1981, a second test, slightly modified to allow for spectral matching data collection, was conducted. In this test, the TM/PF was aligned to the TM calibrator (a collimator and several light sources) (Fig. 14). The output of each channel to the TM calibrator MTF source (a small integrating sphere) was recorded and converted to radiance using the gains and offsets from the first test. The MTF source was filtered for the band 1, 2 and 4 tests. As the large integrating sphere and the MTF light source were spectrally different, this provided a spectral matching test, with the differences in output between channels to the second source indicating the mismatch.

The spectral mismatch was determined as follows:

1. Using the gains and offsets of each channel in a band from the 29-30 June large integrating sphere test, the effective spectral radiance of the calibrator MTF source in each channel was calculated from the 8-11 July test output, e.g. band 1 channel 1:

	<u>Parameter</u>	<u>Units</u>	<u>Value</u>	<u>Source</u>
a.	GAIN	(mux/mw cm ⁻² st-1μm ⁻¹)	16.490	29-30 June test
b.	OFFSET	(mux)	1.187	29-30 June test
c.	OUTPUT TO CALIBRATOR	(mux)	146.720	8-11 July test
d.	EFFECTIVE SPECTRAL RADIANCE	(mw/cm ² st μm)	8.825	$\frac{(c)-(b)}{(a)}$

2. The channels with the maximum and minimum effective spectral radiances in each band were determined. The difference in their spectral radiances was the spectral mismatch. This difference was expressed as a percentage of the average output of all channels in the band to the calibrator or as a percentage of the minimum saturation level. The first number gave a better measure of the spectral mismatch; the second number was useful for comparing to the specifications.

Although a spectral matching test, this test was not responsive to the original NASA specifications. It somewhat more closely matched a set of spectral matching

*Hughes Aircraft Company, SBRC, "Spectral Matching Test Requirement-Supplement to Test BL07," internal memorandum HS236-692, July 21, 1980.

parameters provided by the Landsat-4 science office (Fig. 15).

TM/PF Results

The results of the TM/PF spectral matching tests (Table 3)* showed "spectral mismatches" of up to 6% of signal values (2% of minimum saturation levels), suggesting that either the detectors were poorly matched within bands or the filters had significant local variations in spectral transmittance. Two factors may have caused the indicated spectral mismatches to be greater than the actual values. First, the two tests were conducted about two weeks apart. Although TM detectors are stable relative to MSS photomultipliers, some changes in gains and offsets may have affected the results. Second, measurements of the TM calibrator's MTF spherical integrating source (SIS) indicated significant non-uniformities in illumination. As in the test using the calibrator's SIS, each channel views a different portion of the source, these non-uniformities could have contributed to inflating the spectral mismatches.[†] No additional spectral matching tests were performed on the TM/PF to improve the spectral mismatch estimates.

TM/F Procedure[‡]

The spectral matching test was redesigned for the TM/F tests. Data from a 1.22 m integrating sphere test (14 July 1982) were again used to provide the gains and offsets. Then, a new second test, conducted on 15 July 1982 provided the alternate spectral source. In this test a laboratory collimator and a 15 cm integrating sphere replaced the TM calibrator with its spherical integrating source. In addition, a new set of spectral filters was obtained, such that the differences in spectral slopes of the two sources closely approximated the specified differences.

A second modified TM/F spectral matching test was conducted in an attempt to reduce the inflation of the spectral mismatch due to any non-uniformities of this 15 cm integrating sphere. In this test, the same data as before were taken with the filtered source mounted in the collimator and a second set of data was taken with the spectral filter removed. The data, signal levels in MUX, were converted to effective spectral radiance using the 1.22 m sphere calibration. To calculate spectral mismatch, the minimum difference in any channel's output to the two sources was subtracted from the maximum difference in any channels output to give the error quantity, which was then expressed as a percentage of the output or the minimum saturation level. An additional correction was applied to the resultant percentages to account for the fact that the difference in spectra for the collimator with and without filters did not conform to the specified values.

*Hughes Aircraft Co., SBRC, "TM PF BL07R Test Result Summary," internal memorandum, HS236-7567, July 23, 1981.

+Hughes Aircraft Co., SBRC, "Protoflight Spectral Matching Performance Revisited," internal memorandum, HS236-7608, August 25, 1981.

†Hughes Aircraft Co., SBRC, "TM Spectral Matching," internal memorandum, HS236-7873, March 1, 1982.

TM/F Results

Results of the first test (Table 4)* were generally "better" than in the TM/PF tests, except in band 4 where the TM/F test was more severe than the TM/PF test. Still, specifications were not indicated as being met in bands 1, 4 and 5. In the second test (Table 5) better performance was indicated, with all but band 4 meeting specifications.

To provide a reference point for the TM/F spectral mismatch results, the spectral mismatches of the five existing MSS sensors were calculated using their measured channel-by-channel relative spectral responses (Norwood et al., 1972; Felkel et al., 1977; Markham and Barker, 1982) for the specified targets (Table 6).[†] The TM spectral mismatches fell within the range of MSS mismatches or were somewhat better. Thus, if the TM/F results can also be considered representative of the TM/PF spectral mismatches, no greater spectral striping problems can be expected on the TM than on past MSS's.

*Hughes Aircraft Company, SBRC, "Spectral Matching Test Results--Second Revision," internal memorandum, HS236-8084-2, July 21, 1982.

[†]The output of each MSS channel was calculated as:

$$\text{OUTPUT} = \frac{\sum_{I=a}^b \text{SR}(I) * \text{RSR}(I)}{\sum_{I=a}^b \text{RSR}(I)}$$

Where:

- I - points of RSR measurement
- a,b - range of non-zero relative spectral responses for channel
- SR(I) - sloped radiance at I for comparable TM Band (mw/cm² st μm)
- RSR(I) - relative spectral response of channel at I
- OUTPUT - output of channel (mw/cm² st μm)

The maximum output minus the minimum output equalled the spectral mismatch. This divided by the average output in the band provided the percentage spectral mismatch.

PRIMARY FOCAL PLANT LIGHT LEAKS*

One additional spectrally related characteristic observed on the TM/F was a family of light leaks in the primary focal plane. These leaks were discovered during the spatial coverage testing of the TM/F. The light leaks have the following characteristics:

1. They affect all four bands in the prime focal plane (PFP) and no bands in the cooled focal plane (CFP).
2. They appear as secondary maxima in the scan direction line spread function (Fig. 16).
3. Their position is the same for both the odd and even half bands, (the odd and even detectors are displaced from each other by 2.5 IFOV's) (Table 7). The magnitude of the light leaks is the same for all detectors in a half-band.
4. They are roughly 20 IFOV's (track direction) by 1 IFOV (scan direction) in dimensions.
5. They are white leaks: the light does not pass through the spectral filters, though their relative magnitude does depend on the spectral character of the illumination.

The location and shape of the light leaks suggests they are associated with the gaps between the filter mounts in the primary focal plane (Fig. 4). The gaps between the filter mounts and the slots between the individual band assemblies do not perfectly coincide. This may be allowing light to scatter into the detectors. Note that the PFP diagram is for the TM/PF, whereas the light leak data is the TM/F. It is believed that the TM/PF has comparable leaks, though not exactly at the same locations and of the same magnitudes. Also note that the worst measured light leak was about 1% of the detector's response, though this percentage would be greater when the detector is centered on a dark target and the light leaks are centered on a neighboring bright area.

SUMMARY

Spectral coverage for the TM/PF and TM/F instruments was determined by analyses of spectral measurements of the optics, filters and detectors. Individual channel relative spectral responses were not measured. In the reflective bands, optics accounted for the only differences between the TM/PF and the TM/F, and the calculated spectral responses were similar. The only significant deviation from specifications in the reflective bands was the band 5 upper-band edge which extended to 1784 nm into an atmospheric water absorption region. In band 6 (emissive thermal) the TM/PF and TM/F had fundamentally different spectral responses. The TM/PF upper-band edge was lower than specifications, however the detectors were sufficiently sensitive to exceed the 0.5°K radiometric specification, so the narrower bandwidth was not critical. The TM/F met the upper-band edge specification, as well as the radiometric specification, but was less sensitive overall.

*Hughes Aircraft Co., SBRC, "Light Leaks in the Prime Focal Plane Assembly-II," internal memorandum, HS236-8163, November 19, 1982.

FIGURE 9
COMPARISON OF CALIBRATION PULSES BETWEEN FORWARD AND
REVERSE SCANS
POSTLAUNCH DATA



Band 1 and band 3 filters had minor transmission peaks in the near-IR region: 0.5% and 0.7% at 800 nm and 885 nm respectively for band 1, 2.8% and 1.2% at 945 nm and 1000 nm respectively for band 3.

Satisfactory spectral matching data for the TM/PF was never obtained. The TM/F spectral matching data indicated within specification performance ($\leq 0.5\%$) for all but band 4 (1.7%). Comparison to MSS performance indicated TM performed comparably or better than MSS's in spectral matching.

Several minor leaks were detected in the TM/F prime focal plane. The odd channels of band 1 (magnitude of the light leaks comparable for all detectors in a half band), had the largest light leaks. In the band 1 odd channels, with the TM calibrator 'white' light source, a light leak at 13.1 IFOV along scan off the detector center made about a 1% contribution to the signal. The location and shape of the light leaks suggests that they are associated with the slots at the sides of the individual band assemblies. It is believed the TM/PF has comparable light leaks.

ACKNOWLEDGEMENTS

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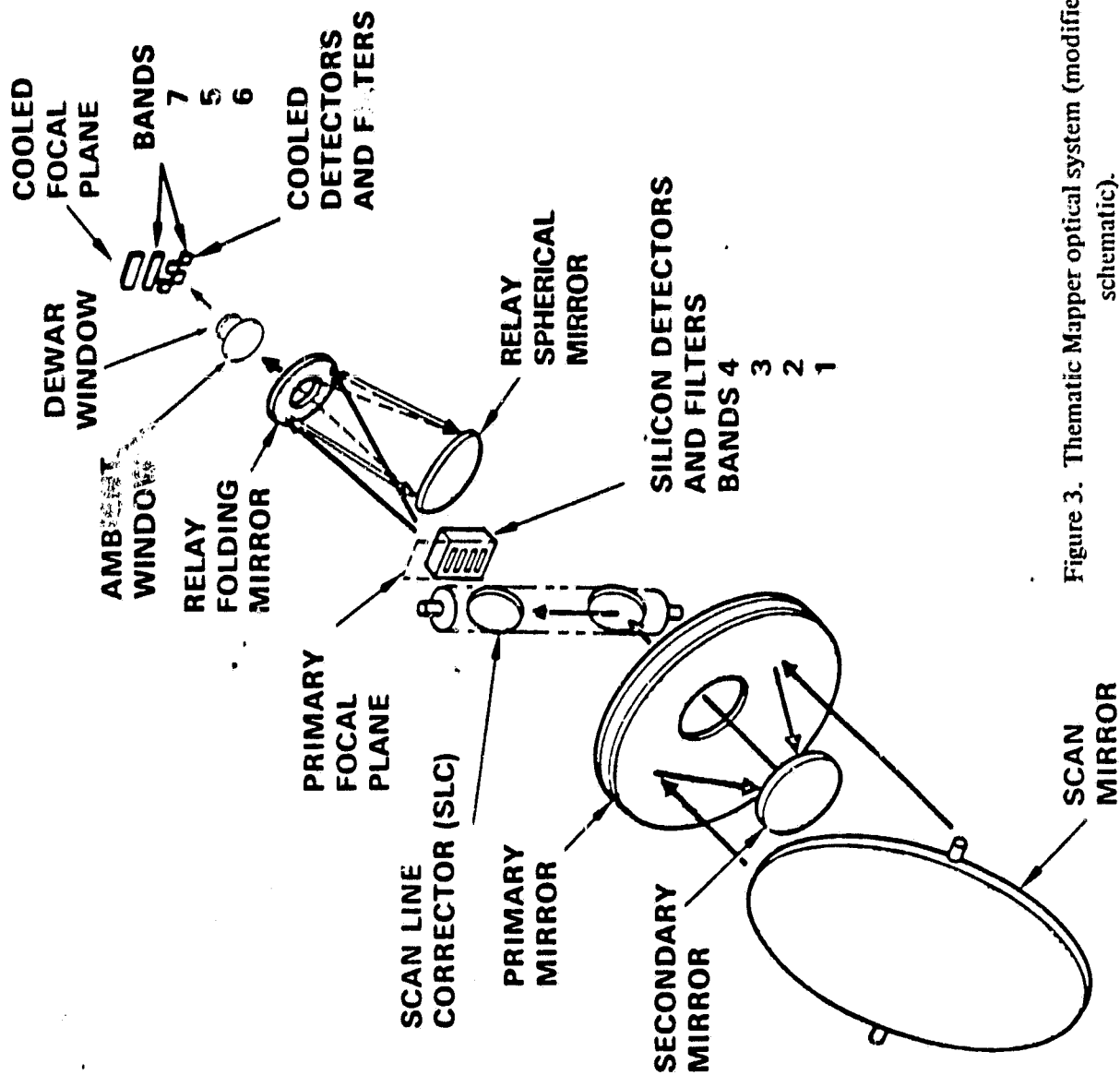


Figure 3. Thematic Mapper optical system (modified Hughes schematic).

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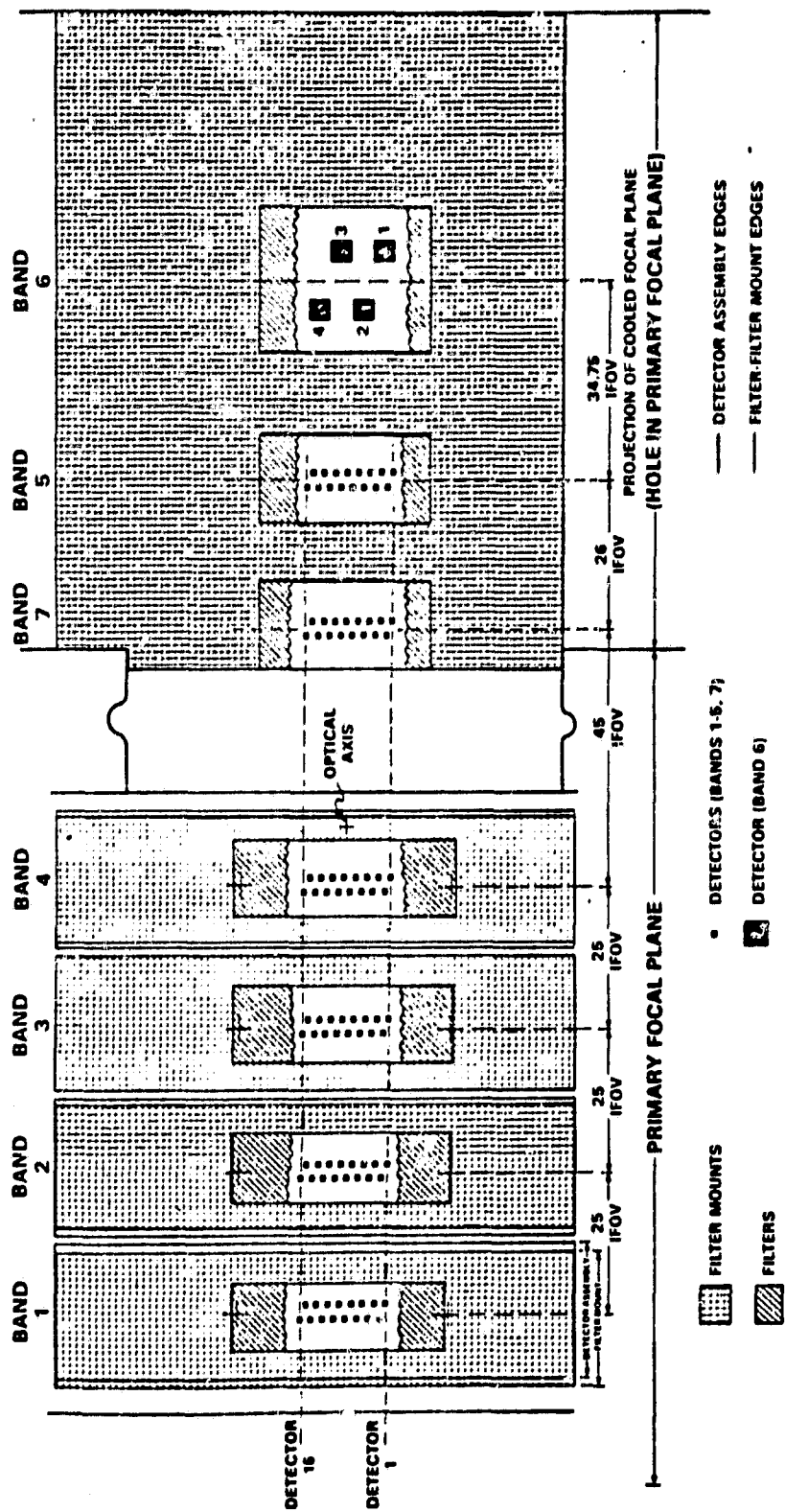
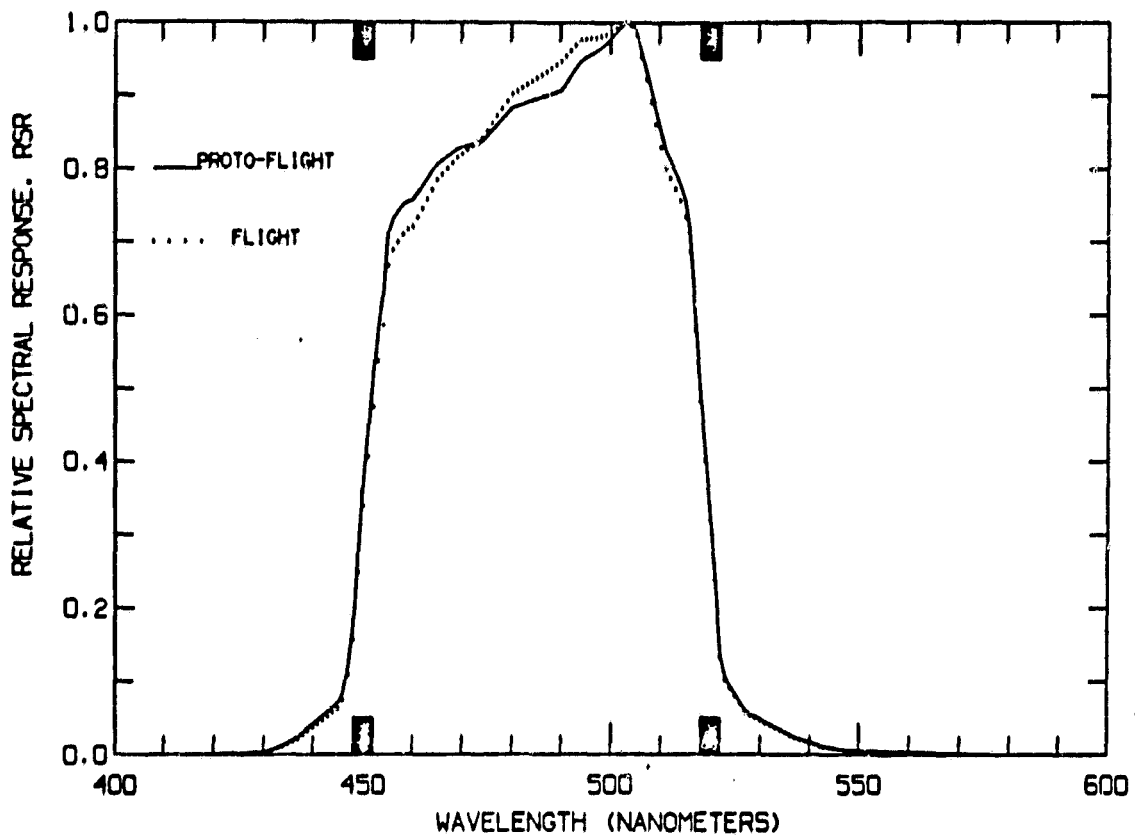


Figure 4. TM/PF primary focal plane and projection of cooled focal plane at primary focal plane.

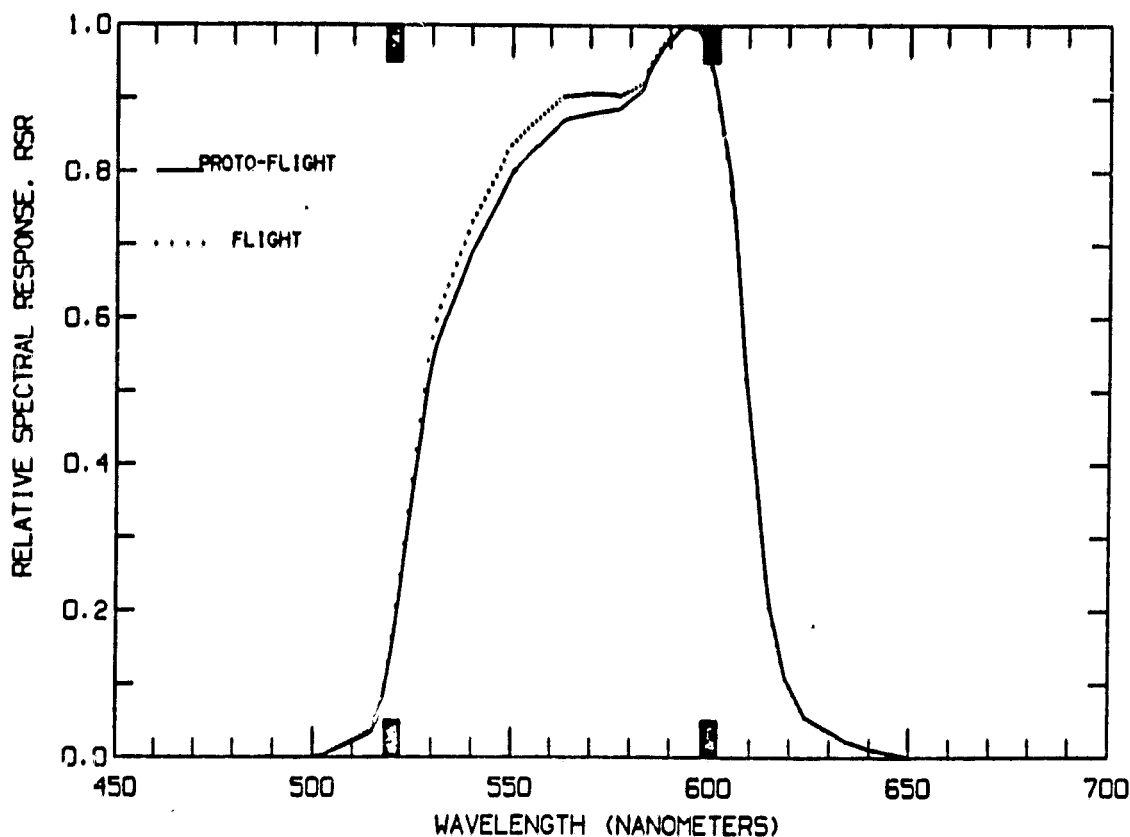
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<u>SPECTRAL PARAMETER</u>	<u>SPECIFICATION</u>	<u>PROTOFLIGHT</u>	<u>FLIGHT</u>
LOWER BAND EDGE (nm)	450 ± 10	452	452
UPPER BAND EDGE (nm)	520 ± 10	518	518
LOWER BAND EDGE SLOPE (nm)			
20% TO 70%	20 (MAX)	7	8
5% TO 70%	30 (MAX)	14	15
UPPER BAND EDGE SLOPE (nm)			
70% TO 20%	20 (MAX)	5	6
70% TO 5%	40 (MAX)	14	14
FLATNESS (%)	—	32	42
WITH LINEAR CORRECTION	75 (MIN)	78	76

Figure 5. Thematic Mapper spectral performance — band 1.

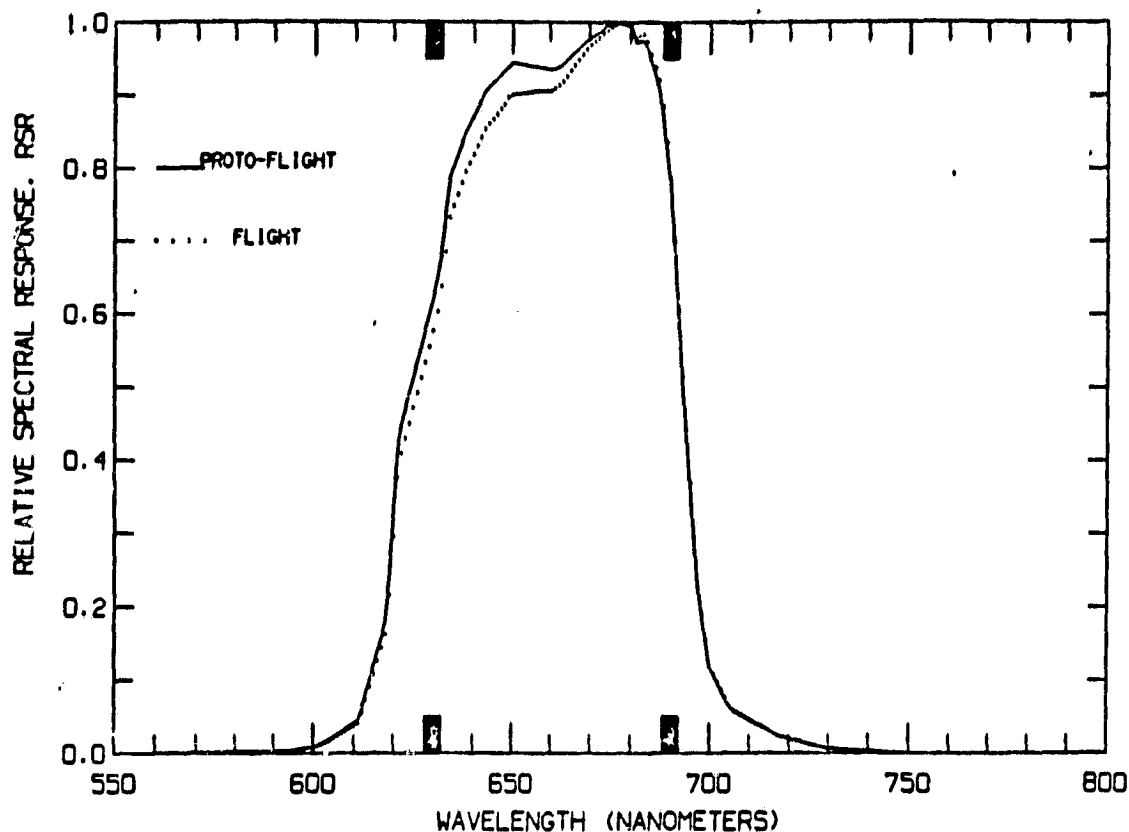
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SPECTRAL PARAMETER	SPECIFICATION	PROTOFLIGHT	FLIGHT
LOWER BAND EDGE (nm)	520 ± 10	529	528
UPPER BAND EDGE (nm)	600 ± 10	610	610
LOWER BAND EDGE SLOPE (nm)			
20% TO 70%	20 (MAX)	20	17
5% TO 70%	30 (MAX)	25	22
UPPER BAND EDGE SLOPE (nm)			
70% TO 20%	20 (MAX)	9	9
70% TO 5%	40 (MAX)	19	18
FLATNESS (%)	—	26	48
WITH LINEAR CORRECTION	75 (MIN)	71 *	72 *
* OUT OF SPECIFICATION			

Figure 6. Thematic Mapper spectral performance — band 2.

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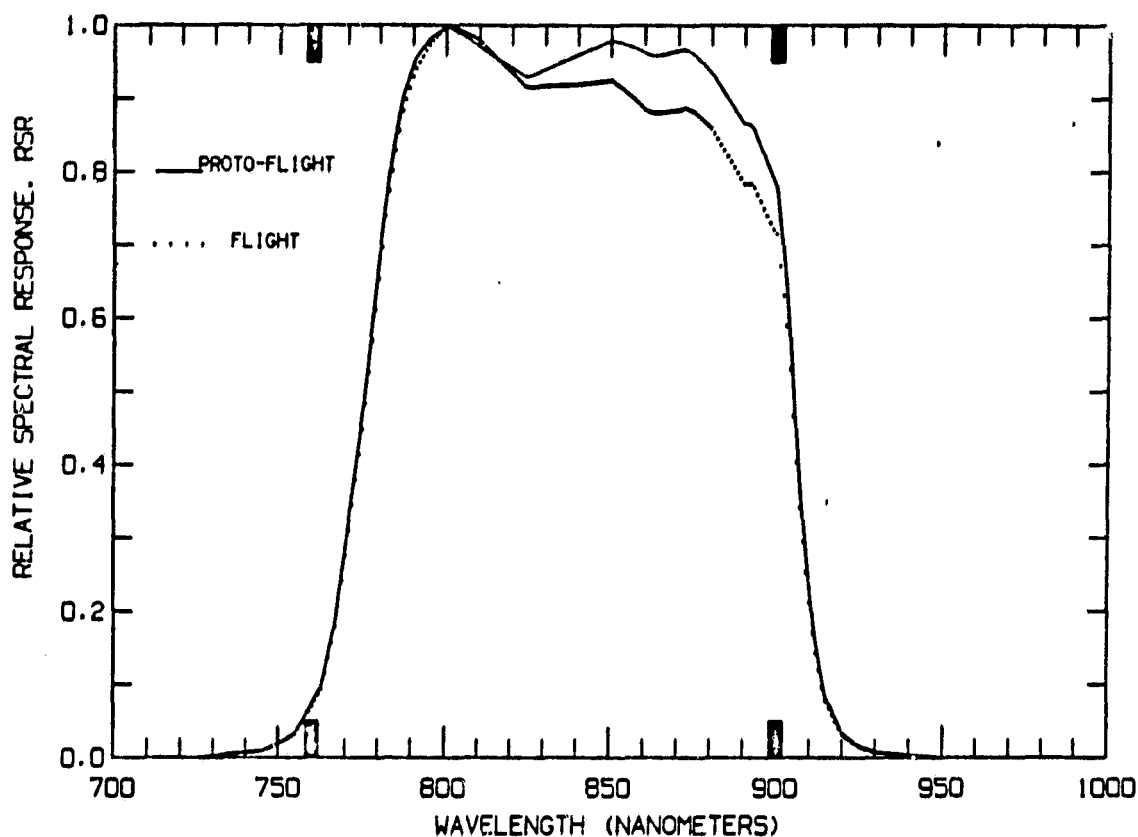


<u>SPECTRAL PARAMETER</u>	<u>SPECIFICATION</u>	<u>PROTOFLIGHT</u>	<u>FLIGHT</u>
LOWER BAND EDGE (nm)	630 ± 20	624	626
UPPER BAND EDGE (nm)	690 ± 10	693	693
LOWER BAND EDGE SLOPE (nm)			
20% TO 70%	20 (MAX)	14	15
5% TO 70%	30 (MAX)	21	22
UPPER BAND EDGE SLOPE (nm)			
70% TO 20%	20 (MAX)	7	6
70% TO 5%	40 (MAX)	18	18
FLATNESS (%)	—	65	56
WITH LINEAR CORRECTION	75 (MIN)	71 •	73 •

• OUT OF SPECIFICATION

Figure 7. Thematic Mapper spectral performance — band 3.

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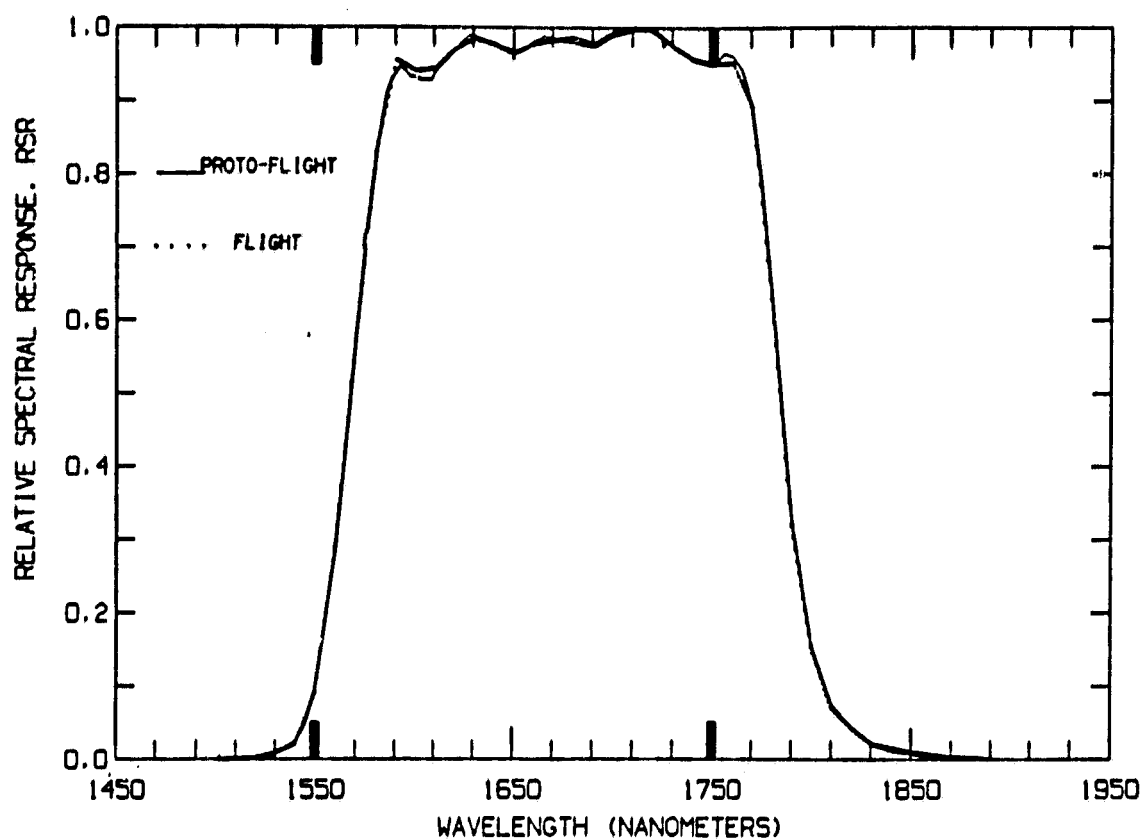


SPECTRAL PARAMETER	SPECIFICATION	PROTOFLIGHT	FLIGHT
LOWER BAND EDGE (nm)	760 ± 20	776	776
UPPER BAND EDGE (nm)	900 ± 10	905	904
LOWER BAND EDGE SLOPE (nm)			
20% TO 70%	20 (MAX)	13	13
5% TO 70%	30 (MAX)	23	24
UPPER BAND EDGE SLOPE (nm)			
70% TO 20%	30 (MAX)	9	10
70% TO 5%	40 (MAX)	17	18
FLATNESS (%)	—	76	53
WITH LINEAR CORRECTION	75 (MIN)	†	81

† NO CORRECTION NEEDED

Figure 8. Thematic Mapper spectral performance — band 4.

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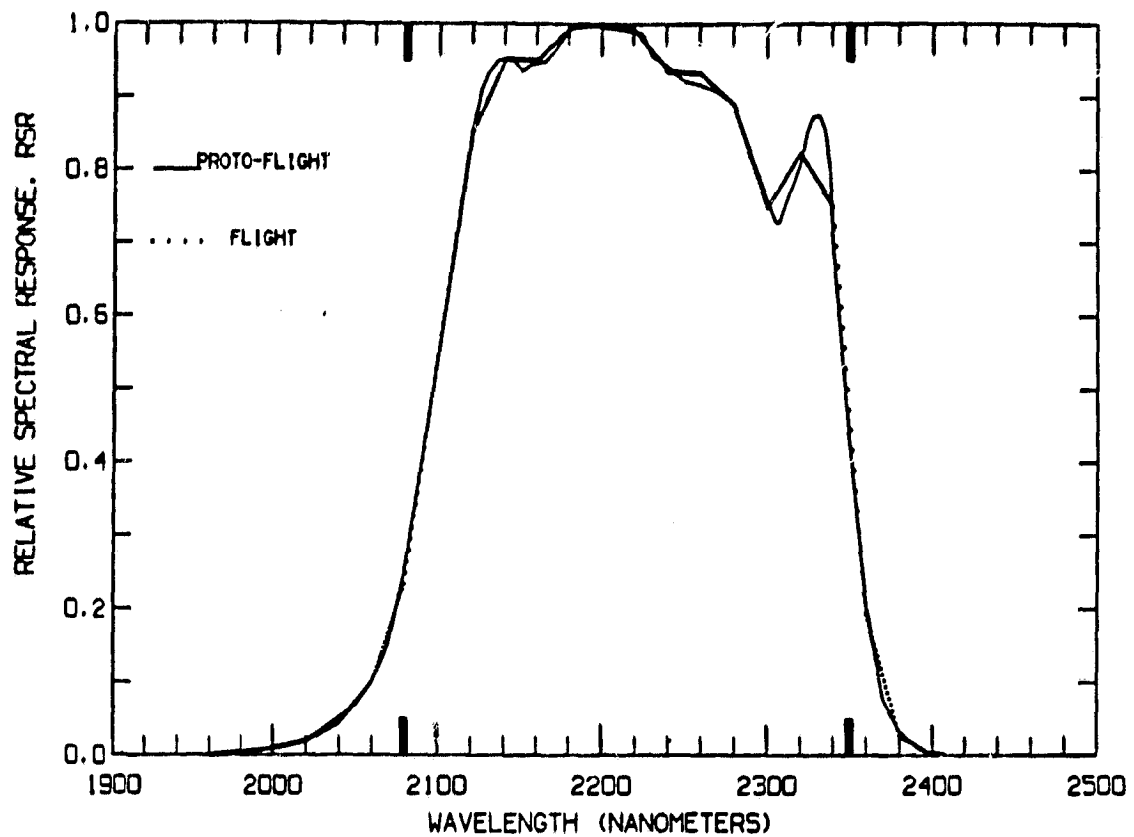


<u>SPECTRAL PARAMETER</u>	<u>SPECIFICATION</u>	<u>PROTOFLIGHT</u>	<u>FLIGHT</u>
LOWER BAND EDGE (nm)	1550 ± 20	1568	1567
UPPER BAND EDGE (nm)	1750 ± 20	1784 *	1784 *
LOWER BAND EDGE SLOPE (nm) 5% TO 75%	50 (MAX)	32	33
UPPER BAND EDGE SLOPE (nm) 75% TO 5%	50 (MAX)	42	43
FLATNESS (%)	75 (MIN)	84	84

* OUT OF SPECIFICATION

Figure 9. Thematic Mapper spectral performance — band 5.

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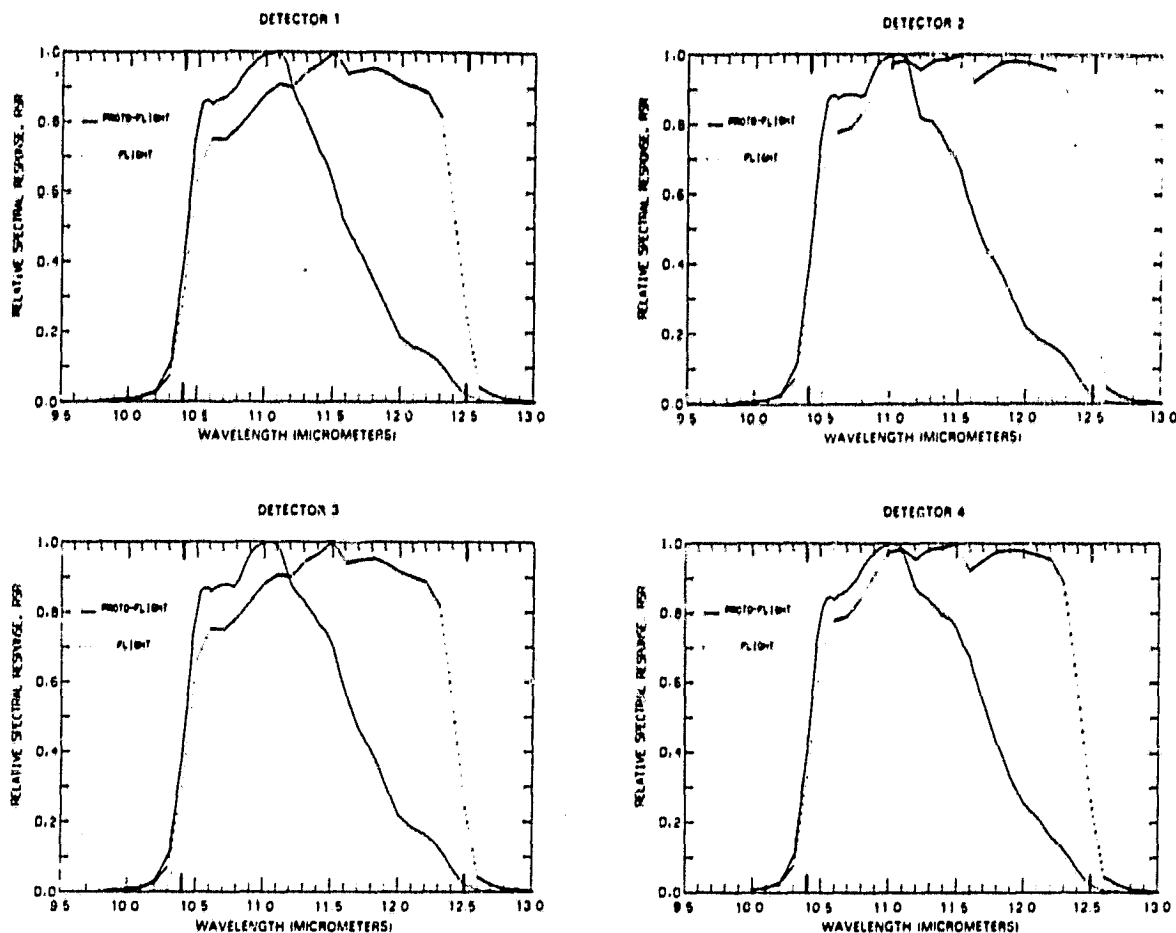


<u>SPECTRAL PARAMETER</u>	<u>SPECIFICATION</u>	<u>PROTOFLIGHT</u>	<u>FLIGHT</u>
LOWER BAND EDGE (nm)	2080 ± 30	2097	2097
UPPER BAND EDGE (nm)	2350 ± 30	2347	2349
LOWER BAND EDGE SLOPE (nm) 5% TO 75%	80	75	71
UPPER BAND EDGE SLOPE (nm) 75% TO 5%	80	37	37
FLATNESS (%)	75	59 *	57 *

*OUT OF SPECIFICATION

Figure 10. Thematic Mapper spectral performance — band 7.

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<u>SPECTRAL PARAMETER</u>	<u>SPECIFICATION</u>	<u>PROTOFLIGHT</u>	<u>FLIGHT</u>
LOWER BAND EDGE (μm)	10.4 ± 0.1	10.42	10.45
UPPER BAND EDGE (μm)	12.5 ± 0.1	11.66 *	12.43
LOWER BAND EDGE SLOPE (μm) 5% TO 75%	0.3 (MAX)	0.25	0.34 *
UPPER BAND EDGE SLOPE (μm) 75% TO 5%	0.3 (MAX)	1.01 *	0.26
FLATNESS (%)	75	67 *	78

*OUT OF SPECIFICATION

Figure 11. Thematic Mapper spectral performance — band 6.

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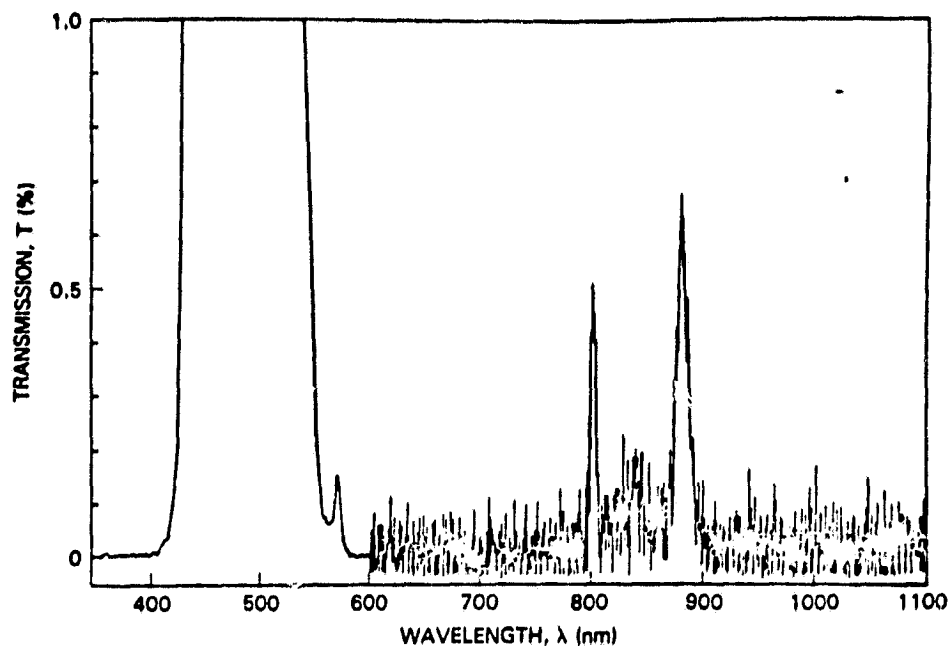


Figure 12. Thematic Mapper band 1 out-of-band filter transmission. Note scale 0-1%.

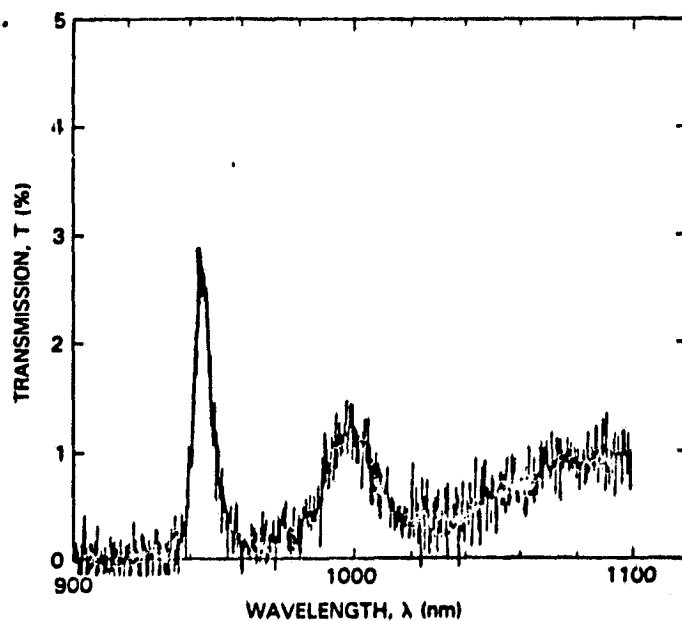


Figure 13. Thematic Mapper band 3 out-of-band filter transmission between 900 & 1100 nm. Note scale 0-5%.

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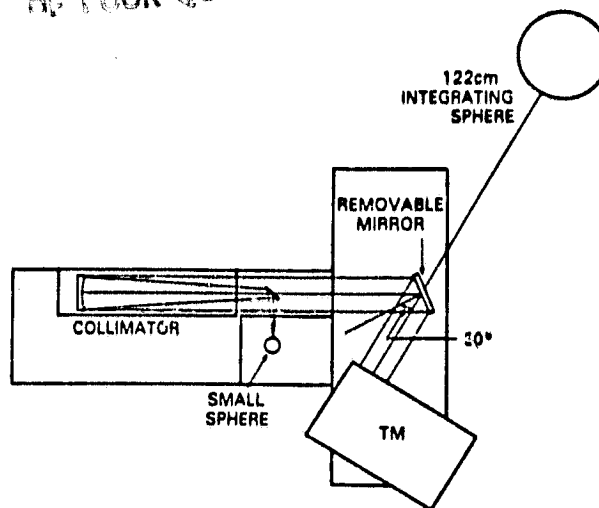


Figure 14. Spectral matching test schematic. One set of measurements was taken viewing the large integrating sphere (mirror removed). A second set of measurements was taken viewing the small sphere (mirror in place). The TM calibrator with MTF source acted as the collimator/small sphere for the PF tests. A laboratory collimator and a separate small sphere were used for the F tests.

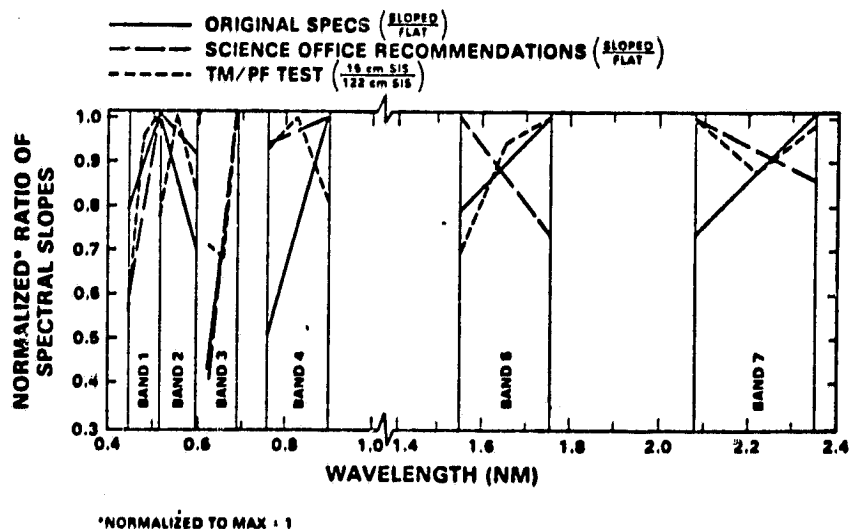


Figure 15. Ratio of spectral slopes of Spherical Integration Sources (SIS) used for TM/PF spectral matching tests in relation to specifications and science office recommendations. TM/F tests simulated the original specifications.

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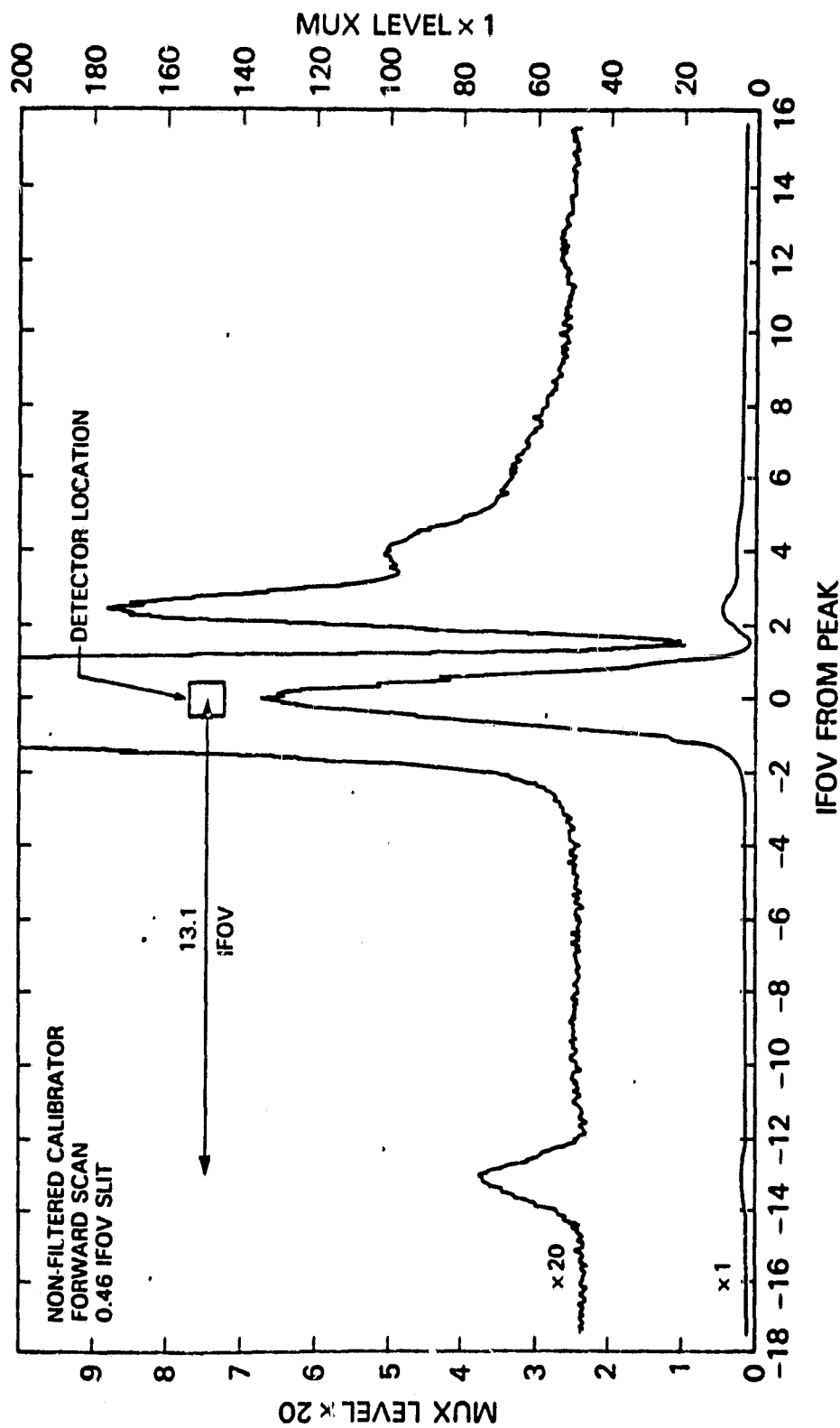


Figure 16. TM/F band 1 odd-channel forward scan line spread function showing location of light leak at 13.1 IFOV off of detector center.

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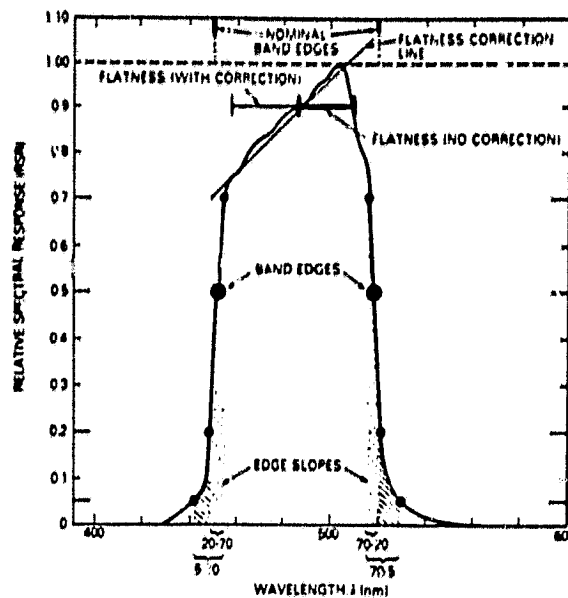


Figure 1. Spectral coverage parameters under specification for TM bands 1-4. The bands 5-7 specifications were on the 5-75% edge slope and the band 6 flatness specification was at 80% RSR.

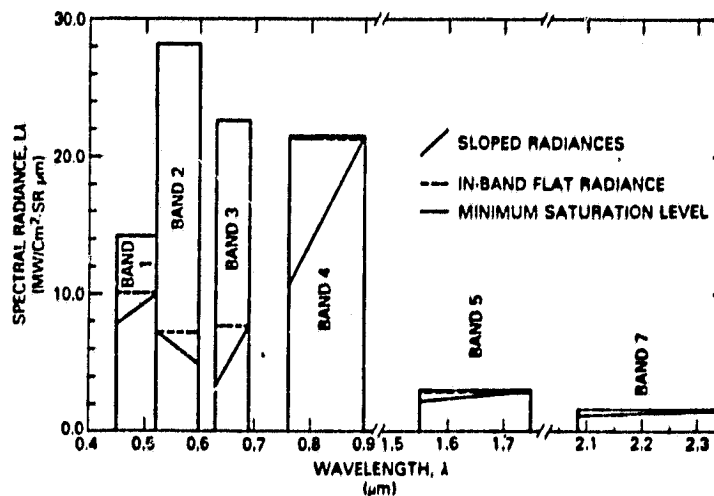


Figure 2. Spectral matching requirements for the Thematic Mapper reflective bands. When all channels within a band are calibrated to produce equivalent outputs when viewing the specified flat scene radiance, then the maximum difference in output between channels when all are viewing the spectrally sloping scene shall be less than 0.5 percent of the minimum saturation level.

Table 1.
TM Integrated Out-of-Band Responses in Relation
to Specifications

<u>OUT-OF-BAND RESPONSES</u>		
BAND	CALCULATED FROM FILTER TRANSMISSION	(%) SPECIFICATION
1	1.64%	5 (MAX)
2	1.30%	5 (MAX)
3	2.87%	5 (MAX)
4	0.78% *	5 (MAX)
5	0.79%	5 (MAX)
7	1.25%	5 (MAX)
6	0.81% *	5 (MAX)

* DETECTOR RSR AND SOLAR IRRADIANCE CONSIDERED IN CALCULATION

Table 2.
TM/F Peak Responses to Filtered Slit Light Source

BAND IN WHICH OUTPUT MEASURED	SOURCE LIGHT FILTER (BAND #)			
	1	2	3	4
1	120.0	6.6	0.0	1.2
2	2.7	82.0	1.2	0.2
3	<0.2	1.5	105.0	0.2
4	~0.2	~0.2	<0.1	115.0

Table 3.

**TM/PF Spectral Matching Results -- Large and
Filtered Small Integrating Spheres**

BAND	MAXIMUM BETWEEN CHANNEL SPECTRAL MISMATCH		
	PERCENT OF OUTPUT (%)	PERCENT OF MINIMUM SATURATION LEVEL (%)	SPECIFICATION (% MSU)
1	2.3	<u>1.8</u> *	0.5
2	5.9	<u>2.0</u> *	0.5
3	1.3	0.2	0.5
4	0.8	<u>0.6</u> *	0.5
5	1.6	<u>1.2</u> *	0.5
7	2.6	<u>1.2</u> *	0.5

* OUT OF SPECIFICATION

Table 4.

**TM/F Spectral Matching Results Test 1 -- Large
and Filtered Small Integrating Spheres**

BAND	MAXIMUM BETWEEN CHANNEL SPECTRAL MISMATCH		
	PERCENT OF OUTPUT (%)	PERCENT OF MINIMUM SATURATION LEVEL (%)	SPECIFICATION (% MSU)
1	1.67	<u>0.89</u> *	0.50
2	1.20	0.45	0.50
3	1.50	0.35	0.50
4	2.58	<u>1.50</u> *	0.50
5	0.92	<u>0.73</u> *	0.50
7	0.85	0.42	0.50

* OUT OF SPECIFICATION

Table 5.

**TM/PF Spectral Matching Results Test 4 -- Small
Integrating Sphere With and Without Filters**

BAND	MAXIMUM BETWEEN CHANNEL SPECTRAL MISMATCH		
	PERCENT OF OUTPUT (%)	PERCENT OF MINIMUM SATURATION LEVEL (%)	SPECIFICATION (% MSU)
1	0.89	0.46	0.50
2	---	---	0.50
3	1.50	0.34	0.50
4	3.00	<u>1.74</u> +	0.50
5	0.09	0.07	0.50
7	0.22	0.11	0.50

* VALID TEST COULD NOT BE CONDUCTED
+ OUT OF SPECIFICATION

Table 6.

Comparison of MSS to TM/F Spectral Mismatch

MSS BAND	COMPARABLE TM BAND	RANGE OF MSS* SPECTRAL MISMATCHES (% OF SIGNAL)	FLIGHT MODEL TM SPECTRAL MISMATCH (% OF SIGNAL)
1	2	1-5	1.2
2	3	3-10	1.5
3	4	1-4	3.0
4	4	1-5	3.0

* CALCULATED FROM MSS 1, 2, 3, 4 (PF) F CHANNEL BY CHANNEL
RELATIVE SPECTRAL RESPONSE MEASUREMENTS USING THE
COMPARABLE TM BAND SPECIFIED SLOPING RADIANCE

Table 7.
Principal TM/F Primary Focal Plane Light Leaks (Magnitudes > 0.2 MUX with
MTF Slit Source)

HALF-BAND	LEAK POSITION RELATIVE TO CENTRAL MAX (IFOV'S)	LEAK AMPLITUDE (MUX)	LEAK AMPLITUDE (% PEAK RESPONSE)
1-ODD	-13.1	1.3	1.10
1 - EVEN	-15.6	0.45	0.37
	14.7	0.20	0.16
2 - ODD	-12.0	0.20	0.18
2 - EVEN	-	-	-
3 - ODD	-12.0	0.30	0.27
	13.3	0.90	0.80
3 - EVEN	-14.8	0.25	0.21
	9.7	0.30	0.26
4 - ODD	-11.7	0.30	0.24
	12.6	0.20	0.16
4 - EVEN	-14.0	0.60	0.53
	-7.4	0.30	0.26
	10.1	0.20	0.18

APPENDIX A

Table A1

THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE BARO 1

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
412	0.0005	0.0005	453	0.5788	0.5366	494	0.9476	0.9761
413	0.0006	0.0006	454	0.6282	0.5856	495	0.9519	0.9775
414	0.0006	0.0006	455	0.7114	0.6667	496	0.9503	0.9788
415	0.0007	0.0007	456	0.7318	0.6880	497	0.9607	0.9802
416	0.0007	0.0007	457	0.7415	0.6993	498	0.9651	0.9815
417	0.0008	0.0008	458	0.7500	0.7095	499	0.9703	0.9837
418	0.0008	0.0008	459	0.7550	0.7165	500	0.9789	0.9891
419	0.0009	0.0009	460	0.7554	0.7200	501	0.9866	0.9935
420	0.0009	0.0009	461	0.7653	0.7326	502	0.9943	0.9978
421	0.0010	0.0010	462	0.7763	0.7454	503	1.0000	1.0000
422	0.0010	0.0010	463	0.7864	0.7583	504	0.9986	0.9952
423	0.0011	0.0011	464	0.7965	0.7714	505	0.9987	0.9828
424	0.0011	0.0011	465	0.8067	0.7847	506	0.9629	0.9524
425	0.0012	0.0012	466	0.8117	0.7924	507	0.9358	0.9219
426	0.0012	0.0012	467	0.8168	0.8002	508	0.9085	0.8914
427	0.0020	0.0020	468	0.8219	0.8080	509	0.8806	0.8607
428	0.0024	0.0024	469	0.8266	0.8156	510	0.8519	0.8293
429	0.0028	0.0028	470	0.8288	0.8206	511	0.8244	0.8021
430	0.0032	0.0032	471	0.8309	0.8257	512	0.8101	0.7877
431	0.0051	0.0051	472	0.8331	0.8308	513	0.7956	0.7732
432	0.0072	0.0072	473	0.8351	0.8359	514	0.7788	0.7565
433	0.0103	0.0103	474	0.8383	0.8421	515	0.7559	0.7339
434	0.0134	0.0134	475	0.8457	0.8526	516	0.7068	0.6859
435	0.0165	0.0165	476	0.8532	0.8624	517	0.5924	0.5784
436	0.0199	0.0199	477	0.8607	0.8724	518	0.4966	0.4813
437	0.0252	0.0252	478	0.8682	0.8824	519	0.4132	0.4002
438	0.0310	0.0310	479	0.8758	0.8925	520	0.3292	0.3187
439	0.0367	0.0367	480	0.8835	0.9026	521	0.2437	0.2367
440	0.0421	0.0421	481	0.8860	0.9069	522	0.1669	0.1629
441	0.0476	0.0476	482	0.8885	0.9111	523	0.1054	0.1018
442	0.0531	0.0531	483	0.8910	0.9154	524	0.0945	0.0911
443	0.0588	0.0588	484	0.8934	0.9196	525	0.0834	0.0804
444	0.0645	0.0645	485	0.8959	0.9238	526	0.0723	0.0696
445	0.0704	0.0704	486	0.8983	0.9285	527	0.0612	0.0588
446	0.0761	0.0761	487	0.9007	0.9332	528	0.0554	0.0532
447	0.1213	0.1037	488	0.9031	0.9379	529	0.0520	0.0498
448	0.1725	0.1564	489	0.9054	0.9425	530	0.0485	0.0465
449	0.2730	0.2483	490	0.9078	0.9472	531	0.0450	0.0431
450	0.3718	0.3391	491	0.9179	0.9548	532	0.0415	0.0397
451	0.4425	0.4058	492	0.9281	0.9623	533	0.0380	0.0364
452	0.5142	0.4741	493	0.9384	0.9698	534	0.0344	0.0330

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Table A2
THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE - BAND 2

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
501	0.0006	0.0007	539	0.6754	0.7163	577	0.8869	0.9017
502	0.0019	0.0021	540	0.6898	0.7312	578	0.8914	0.9073
503	0.0032	0.0036	541	0.7003	0.7416	579	0.8958	0.9098
504	0.0065	0.0072	542	0.7107	0.7520	580	0.9002	0.9124
505	0.0089	0.0098	543	0.7213	0.7625	581	0.9047	0.9155
506	0.0114	0.0125	544	0.7319	0.7730	582	0.9092	0.9186
507	0.0139	0.0152	545	0.7426	0.7836	583	0.9136	0.9218
508	0.0164	0.0179	546	0.7533	0.7941	584	0.9181	0.9332
509	0.0190	0.0206	547	0.7642	0.8047	585	0.9223	0.9392
510	0.0215	0.0233	548	0.7751	0.8153	586	0.9265	0.9503
511	0.0241	0.0261	549	0.7861	0.8260	587	0.9306	0.9501
512	0.0268	0.0290	550	0.7971	0.8367	588	0.9347	0.9683
513	0.0295	0.0318	551	0.8081	0.8475	589	0.9388	0.9768
514	0.0322	0.0347	552	0.8191	0.8583	590	0.9429	0.9819
515	0.0349	0.0377	553	0.8301	0.8691	591	0.9470	0.9871
516	0.0376	0.0404	554	0.8411	0.8799	592	0.9511	0.9922
517	0.0402	0.0432	555	0.8521	0.8907	593	0.9552	0.9973
518	0.0429	0.0462	556	0.8631	0.9015	594	0.9593	1.0000
519	0.0455	0.0492	557	0.8741	0.9123	595	0.9634	0.9978
520	0.0481	0.0520	558	0.8851	0.9231	596	0.9675	0.9951
521	0.0507	0.0555	559	0.8961	0.9339	597	0.9716	0.9924
522	0.0533	0.0589	560	0.9071	0.9447	598	0.9757	0.9897
523	0.0559	0.0625	561	0.9181	0.9555	599	0.9798	0.9869
524	0.0585	0.0661	562	0.9291	0.9663	600	0.9839	0.9840
525	0.0611	0.0707	563	0.9401	0.9771	601	0.9880	0.9799
526	0.0637	0.0753	564	0.9511	0.9879	602	0.9921	0.9750
527	0.0663	0.0800	565	0.9621	0.9987	603	0.9962	0.9701
528	0.0689	0.0846	566	0.9731	1.0095	604	1.0003	0.9652
529	0.0715	0.0892	567	0.9841	1.0203	605	1.0044	0.9603
530	0.0741	0.0938	568	0.9951	1.0311	606	1.0085	0.9554
531	0.0767	0.0984	569	1.0061	1.0419	607	1.0126	0.9505
532	0.0793	0.1030	570	1.0171	1.0527	608	1.0167	0.9456
533	0.0819	0.1076	571	1.0281	1.0635	609	1.0208	0.9407
534	0.0845	0.1122	572	1.0391	1.0743	610	1.0249	0.9358
535	0.0871	0.1168	573	1.0501	1.0851	611	1.0290	0.9309
536	0.0897	0.1214	574	1.0611	1.0959	612	1.0331	0.9260
537	0.0923	0.1260	575	1.0721	1.1067	613	1.0372	0.9211
538	0.0949	0.1306	576	1.0831	1.1175	614	1.0413	0.9162

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Table A3

THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE - BAND 3

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
559	0.0007	.....	607	0.0304	0.0372	655	0.9397	0.9052	703	0.0844	0.0864
560	0.0008	.....	608	0.0341	0.0306	656	0.9388	0.9055	704	0.0737	0.0756
561	0.0009	.....	609	0.0378	0.0340	657	0.9379	0.9058	705	0.0629	0.0646
562	0.0009	.....	610	0.0415	0.0375	658	0.9370	0.9060	706	0.0569	0.0584
563	0.0010	.....	611	0.0453	0.0409	659	0.9360	0.9062	707	0.0539	0.0555
564	0.0011	.....	612	0.0616	0.0555	660	0.9351	0.9064	708	0.0510	0.0525
565	0.0012	.....	613	0.0811	0.0730	661	0.9372	0.9104	709	0.0480	0.0494
566	0.0013	.....	614	0.1007	0.0906	662	0.9394	0.9143	710	0.0450	0.0464
567	0.0014	.....	615	0.1204	0.1082	663	0.9429	0.9155	711	0.0420	0.0433
568	0.0014	.....	616	0.1402	0.1262	664	0.9483	0.9266	712	0.0390	0.0402
569	0.0015	.....	617	0.1602	0.1444	665	0.9537	0.9338	713	0.0371	0.0380
570	0.0016	.....	618	0.1803	0.1626	666	0.9591	0.9412	714	0.0330	0.0340
571	0.0017	.....	619	0.2402	0.2169	667	0.9646	0.9488	715	0.0300	0.0309
572	0.0017	.....	620	0.3271	0.2958	668	0.9700	0.9563	716	0.0270	0.0277
573	0.0017	.....	621	0.4145	0.3759	669	0.9755	0.9640	717	0.0239	0.0246
574	0.0018	.....	622	0.4991	0.4086	670	0.9793	0.9699	718	0.0224	0.0230
575	0.0018	.....	623	0.4706	0.4293	671	0.9831	0.9749	719	0.0210	0.0215
576	0.0019	0.0017	624	0.4921	0.4503	672	0.9869	0.9789	720	0.0195	0.0200
577	0.0019	0.0017	625	0.5138	0.4715	673	0.9904	0.9847	721	0.0186	0.0185
578	0.0020	0.0017	626	0.5354	0.4923	674	0.9969	0.9895	722	0.0166	0.0169
579	0.0020	0.0018	627	0.5572	0.5132	675	0.9964	0.9932	723	0.0151	0.0154
580	0.0021	0.0018	628	0.5790	0.5343	676	0.9982	0.9966	724	0.0136	0.0139
581	0.0021	0.0019	629	0.6010	0.5555	677	1.0000	1.0000	725	0.0121	0.0123
582	0.0022	0.0019	630	0.6235	0.5774	678	0.9977	0.9995	726	0.0109	0.0111
583	0.0022	0.0020	631	0.6504	0.6031	679	0.9957	0.9989	727	0.0097	0.0099
584	0.0023	0.0020	632	0.6866	0.6374	680	0.9936	0.9983	728	0.0085	0.0087
585	0.0023	0.0020	633	0.7365	0.6848	681	0.9725	0.9784	729	0.0074	0.0074
586	0.0024	0.0021	634	0.7869	0.7325	682	0.9734	0.9806	730	0.0061	0.0062
587	0.0024	0.0021	635	0.8027	0.7482	683	0.9742	0.9827	731	0.0058	0.0059
588	0.0025	0.0022	636	0.8185	0.7642	684	0.9635	0.9732	732	0.0055	0.0056
589	0.0025	0.0022	637	0.8145	0.7802	685	0.9451	0.9558	733	0.0052	0.0053
590	0.0026	0.0023	638	0.8185	0.7947	686	0.9265	0.9384	734	0.0049	0.0050
591	0.0029	0.0026	639	0.8598	0.8065	687	0.9078	0.9209	735	0.0046	0.0047
592	0.0033	0.0029	640	0.8711	0.8065	688	0.8710	0.8850	736	0.0043	0.0044
593	0.0037	0.0032	641	0.8826	0.8304	689	0.8220	0.8364	737	0.0040	0.0040
594	0.0040	0.0035	642	0.8941	0.8424	690	0.7727	0.7874	738	0.0037	0.0037
595	0.0044	0.0039	643	0.9C56	0.8545	691	0.7869	0.7900	739	0.0034	0.0034
596	0.0053	0.0046	644	0.9116	0.8614	692	0.5910	0.5932	740	0.0031	0.0031
597	0.0062	0.0054	645	0.9170	0.8678	693	0.5019	0.5143	741	0.0028	0.0028
598	0.0071	0.0062	646	0.9224	0.8743	694	0.4333	0.4413	742	0.0025	0.0025
599	0.0080	0.0070	647	0.9278	0.8809	695	0.3612	0.3678	743	0.0019	0.0019
600	0.0089	0.0079	648	0.9332	0.8875	696	0.2888	0.2942	744	0.0016	0.0016
601	0.0114	0.0101	649	0.9386	0.8971	697	0.2235	0.2277	745	0.0016	0.0016
602	0.0139	0.0123	650	0.9441	0.9008	698	0.1879	0.1916	746	0.0012	0.0012
603	0.0165	0.0146	651	0.9433	0.9017	699	0.1522	0.1552	747	0.0009	0.0009
604	0.0194	0.0173	652	0.9424	0.9026	700	0.1162	0.1186	748	0.0006	0.0006
605	0.0231	0.0205	653	0.9415	0.9035	701	0.1056	0.1079	749	0.0003	0.0003
606	0.0267	0.0238	654	0.9406	0.9044	702	0.0950	0.0972			

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Table A4
THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE - BAND 4

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
726	0.0005	0.0005	783	0.7950	0.7745	839	0.9578	0.9194
727	0.0010	0.0010	784	0.8218	0.8017	840	0.9598	0.9196
728	0.0014	0.0014	785	0.8487	0.8290	841	0.9618	0.9208
729	0.0019	0.0019	786	0.8756	0.8561	842	0.9638	0.9208
730	0.0024	0.0024	787	0.9025	0.8838	843	0.9658	0.9208
731	0.0029	0.0029	788	0.9294	0.9107	844	0.9677	0.9208
732	0.0033	0.0033	789	0.9563	0.9376	845	0.9697	0.9208
733	0.0038	0.0038	790	0.9832	0.9645	846	0.9717	0.9208
734	0.0043	0.0043	791	0.9564	0.9376	847	0.9737	0.9208
735	0.0048	0.0048	792	0.9629	0.9439	848	0.9756	0.9208
736	0.0053	0.0053	793	0.9695	0.9500	849	0.9776	0.9208
737	0.0058	0.0058	794	0.9760	0.9561	850	0.9796	0.9208
738	0.0063	0.0063	795	0.9826	0.9622	851	0.9816	0.9208
739	0.0067	0.0067	796	0.9891	0.9683	852	0.9836	0.9208
740	0.0072	0.0072	797	0.9956	0.9744	853	0.9856	0.9208
741	0.0077	0.0077	798	0.9999	0.9807	854	0.9876	0.9208
742	0.0082	0.0082	799	0.9565	0.9376	855	0.9726	0.9208
743	0.0087	0.0087	800	0.9630	0.9441	856	0.9746	0.9208
744	0.0092	0.0092	801	0.9695	0.9506	857	0.9766	0.9208
745	0.0097	0.0097	802	0.9760	0.9567	858	0.9786	0.9208
746	0.0102	0.0102	803	0.9825	0.9628	859	0.9806	0.9208
747	0.0107	0.0107	804	0.9890	0.9689	860	0.9826	0.9208
748	0.0112	0.0112	805	0.9955	0.9750	861	0.9846	0.9208
749	0.0117	0.0117	806	0.9999	0.9811	862	0.9866	0.9208
750	0.0122	0.0122	807	0.9565	0.9376	863	0.9726	0.9208
751	0.0127	0.0127	808	0.9630	0.9441	864	0.9746	0.9208
752	0.0132	0.0132	809	0.9695	0.9506	865	0.9766	0.9208
753	0.0137	0.0137	810	0.9760	0.9567	866	0.9786	0.9208
754	0.0142	0.0142	811	0.9825	0.9628	867	0.9806	0.9208
755	0.0147	0.0147	812	0.9890	0.9689	868	0.9826	0.9208
756	0.0152	0.0152	813	0.9955	0.9750	869	0.9846	0.9208
757	0.0157	0.0157	814	0.9999	0.9811	870	0.9866	0.9208
758	0.0162	0.0162	815	0.9565	0.9376	871	0.9726	0.9208
759	0.0167	0.0167	816	0.9630	0.9441	872	0.9746	0.9208
760	0.0172	0.0172	817	0.9695	0.9506	873	0.9766	0.9208
761	0.0177	0.0177	818	0.9760	0.9567	874	0.9786	0.9208
762	0.0182	0.0182	819	0.9825	0.9628	875	0.9806	0.9208
763	0.0187	0.0187	820	0.9890	0.9689	876	0.9826	0.9208
764	0.0192	0.0192	821	0.9955	0.9750	877	0.9846	0.9208
765	0.0197	0.0197	822	0.9999	0.9811	878	0.9866	0.9208
766	0.0202	0.0202	823	0.9565	0.9376	879	0.9726	0.9208
767	0.0207	0.0207	824	0.9630	0.9441	880	0.9746	0.9208
768	0.0212	0.0212	825	0.9695	0.9506	881	0.9766	0.9208
769	0.0217	0.0217	826	0.9760	0.9567	882	0.9786	0.9208
770	0.0222	0.0222	827	0.9825	0.9628	883	0.9806	0.9208
771	0.0227	0.0227	828	0.9890	0.9689	884	0.9826	0.9208
772	0.0232	0.0232	829	0.9955	0.9750	885	0.9846	0.9208
773	0.0237	0.0237	830	0.9999	0.9811	886	0.9866	0.9208
774	0.0242	0.0242	831	0.9565	0.9376	887	0.9726	0.9208
775	0.0247	0.0247	832	0.9630	0.9441	888	0.9746	0.9208
776	0.0252	0.0252	833	0.9695	0.9506	889	0.9766	0.9208
777	0.0257	0.0257	834	0.9760	0.9567	890	0.9786	0.9208
778	0.0262	0.0262	835	0.9825	0.9628	891	0.9806	0.9208
779	0.0267	0.0267	836	0.9890	0.9689	892	0.9826	0.9208
780	0.0272	0.0272	837	0.9955	0.9750	893	0.9846	0.9208
781	0.0277	0.0277	838	0.9999	0.9811	894	0.9866	0.9208
782	0.0282	0.0282						

Table A5
THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE - BAND 5

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
1501	0.0000	0.0001	1561	0.3120	0.3179	1621	0.9719	0.9718	1681	0.9788	0.9854
1502	0.0001	0.0002	1562	0.3399	0.3454	1622	0.9747	0.9733	1682	0.9783	0.9844
1503	0.0002	0.0003	1563	0.3680	0.3732	1623	0.9775	0.9762	1683	0.9783	0.9835
1504	0.0003	0.0004	1564	0.3963	0.4012	1624	0.9803	0.9787	1684	0.9772	0.9825
1505	0.0004	0.0005	1565	0.4248	0.4294	1625	0.9831	0.9777	1685	0.9767	0.9815
1506	0.0005	0.0006	1566	0.4536	0.4578	1626	0.9855	0.9791	1686	0.9762	0.9805
1507	0.0006	0.0007	1567	0.4826	0.4865	1627	0.9877	0.9806	1687	0.9757	0.9796
1508	0.0007	0.0008	1568	0.5118	0.5154	1628	0.9894	0.9821	1688	0.9752	0.9786
1509	0.0008	0.0009	1569	0.5412	0.5446	1629	0.9888	0.9835	1689	0.9746	0.9776
1510	0.0009	0.0010	1570	0.5709	0.5739	1630	0.9882	0.9850	1690	0.9741	0.9766
1511	0.0010	0.0011	1571	0.5980	0.5989	1631	0.9871	0.9842	1691	0.9751	0.9784
1512	0.0010	0.0011	1572	0.6252	0.6239	1632	0.9859	0.9835	1692	0.9767	0.9802
1513	0.0011	0.0012	1573	0.6526	0.6492	1633	0.9848	0.9827	1693	0.9784	0.9820
1514	0.0011	0.0012	1574	0.6801	0.6746	1634	0.9836	0.9820	1694	0.9800	0.9838
1515	0.0012	0.0013	1575	0.7077	0.7002	1635	0.9825	0.9813	1695	0.9816	0.9857
1516	0.0013	0.0014	1576	0.7319	0.7260	1636	0.9813	0.9805	1696	0.9833	0.9875
1517	0.0014	0.0015	1577	0.7546	0.7519	1637	0.9802	0.9798	1697	0.9849	0.9893
1518	0.0015	0.0016	1578	0.7775	0.7781	1638	0.9790	0.9790	1698	0.9855	0.9911
1519	0.0016	0.0017	1579	0.8005	0.8044	1639	0.9778	0.9782	1699	0.9862	0.9926
1520	0.0017	0.0018	1580	0.8236	0.8308	1640	0.9767	0.9776	1700	0.9868	0.9947
1521	0.0018	0.0019	1581	0.8417	0.8430	1641	0.9758	0.9763	1701	0.9905	0.9953
1522	0.0019	0.0020	1582	0.8578	0.8553	1642	0.9749	0.9750	1702	0.9912	0.9958
1523	0.0020	0.0021	1583	0.8740	0.8676	1643	0.9740	0.9737	1703	0.9918	0.9963
1524	0.0021	0.0022	1584	0.8903	0.8800	1644	0.9730	0.9724	1704	0.9925	0.9969
1525	0.0022	0.0023	1585	0.9066	0.8925	1645	0.9721	0.9711	1705	0.9932	0.9974
1526	0.0023	0.0024	1586	0.9165	0.9055	1646	0.9712	0.9699	1706	0.9939	0.9979
1527	0.0024	0.0025	1587	0.9236	0.9175	1647	0.9703	0.9686	1707	0.9946	0.9985
1528	0.0025	0.0026	1588	0.9302	0.9201	1648	0.9694	0.9673	1708	0.9952	0.9990
1529	0.0026	0.0027	1589	0.9344	0.9248	1649	0.9685	0.9660	1709	0.9951	0.9995
1530	0.0027	0.0028	1590	0.9387	0.9355	1650	0.9676	0.9648	1710	0.9951	1.0000
1531	0.0028	0.0029	1591	0.9428	0.9400	1651	0.9672	0.9641	1711	0.9957	0.9997
1532	0.0029	0.0030	1592	0.9468	0.9456	1652	0.9668	0.9674	1712	0.9958	0.9994
1533	0.0030	0.0031	1593	0.9499	0.9511	1653	0.9669	0.9687	1713	0.9959	0.9994
1534	0.0031	0.0032	1594	0.9529	0.9497	1654	0.9679	0.9701	1714	0.9959	0.9988
1535	0.0032	0.0033	1595	0.9559	0.9482	1655	0.9715	0.9714	1715	1.0000	0.9984
1536	0.0033	0.0034	1596	0.9588	0.9453	1656	0.9732	0.9727	1716	0.9991	0.9981
1537	0.0034	0.0035	1597	0.9617	0.9438	1657	0.9750	0.9740	1717	0.9976	0.9978
1538	0.0035	0.0036	1598	0.9646	0.9423	1658	0.9768	0.9753	1718	0.9962	0.9975
1539	0.0036	0.0037	1599	0.9675	0.9409	1659	0.9786	0.9767	1719	0.9947	0.9972
1540	0.0037	0.0038	1600	0.9704	0.9395	1660	0.9803	0.9780	1720	0.9932	0.9968
1541	0.0038	0.0039	1601	0.9733	0.9412	1661	0.9821	0.9795	1721	0.9915	0.9945
1542	0.0039	0.0040	1602	0.9762	0.9428	1662	0.9839	0.9790	1722	0.9896	0.9922
1543	0.0040	0.0041	1603	0.9791	0.9445	1663	0.9857	0.9775	1723	0.9878	0.9899
1544	0.0041	0.0042	1604	0.9820	0.9462	1664	0.9876	0.9800	1724	0.9859	0.9877
1545	0.0042	0.0043	1605	0.9849	0.9479	1665	0.9894	0.9805	1725	0.9740	0.9854
1546	0.0043	0.0044	1606	0.9878	0.9496	1666	0.9913	0.9810	1726	0.9821	0.9831
1547	0.0044	0.0045	1607	0.9907	0.9513	1667	0.9932	0.9815	1727	0.9802	0.9808
1548	0.0045	0.0046	1608	0.9936	0.9530	1668	0.9951	0.9820	1728	0.9784	0.9785
1549	0.0046	0.0047	1609	0.9965	0.9547	1669	0.9970	0.9825	1729	0.9765	0.9763
1550	0.0047	0.0048	1610	0.9994	0.9564	1670	0.9989	0.9830	1730	0.9746	0.9740
1551	0.0048	0.0049	1611	1.0023	0.9581	1671	0.9994	0.9833	1731	0.9727	0.9723
1552	0.0049	0.0050	1612	1.0052	0.9598	1672	0.9999	0.9837	1732	0.9709	0.9706
1553	0.0050	0.0051	1613	1.0081	0.9615	1673	0.9999	0.9840	1733	0.9690	0.9688
1554	0.0051	0.0052	1614	1.0110	0.9632	1674	0.9999	0.9844	1734	0.9671	0.9671
1555	0.0052	0.0053	1615	1.0139	0.9649	1675	0.9999	0.9847	1735	0.9652	0.9654
1556	0.0053	0.0054	1616	1.0168	0.9666	1676	0.9999	0.9850	1736	0.9633	0.9637
1557	0.0054	0.0055	1617	1.0197	0.9683	1677	0.9999	0.9853	1737	0.9615	0.9620
1558	0.0055	0.0056	1618	1.0226	0.9699	1678	0.9999	0.9856	1738	0.9597	0.9603
1559	0.0056	0.0057	1619	1.0255	0.9716	1679	0.9999	0.9859	1739	0.9578	0.9586
1560	0.0057	0.0058	1620	1.0284	0.9733	1680	0.9999	0.9862	1740	0.9559	0.9569

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Table A5
(CONTINUED)

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
1741	0.9549	0.9562	1779	0.6658	0.6542	1816	0.0569	0.0546	1853	0.0098	0.0073
1742	0.9541	0.9555	1780	0.6370	0.6277	1817	0.0538	0.0518	1854	0.0094	0.0068
1743	0.9534	0.9543	1781	0.6072	0.5968	1818	0.0507	0.0491	1855	0.0091	0.0064
1744	0.9526	0.9542	1782	0.5769	0.5659	1819	0.0476	0.0463	1856	0.0087	0.0060
1745	0.9519	0.9536	1783	0.5466	0.5350	1820	0.0446	0.0436	1857	0.0083	0.0055
1746	0.9511	0.9529	1784	0.5163	0.5041	1821	0.0421	0.0414	1858	0.0080	0.0051
1747	0.9504	0.9523	1785	0.4860	0.4732	1822	0.0399	0.0392	1859	0.0076	0.0047
1748	0.9496	0.9516	1786	0.4557	0.4423	1823	0.0377	0.0370	1860	0.0073	0.0043
1749	0.9489	0.9509	1787	0.4254	0.4114	1824	0.0355	0.0348	1861	0.0069	0.0041
1750	0.9482	0.9503	1788	0.3950	0.3806	1825	0.0333	0.0326	1862	0.0065	0.0040
1751	0.9505	0.9505	1789	0.3647	0.3497	1826	0.0311	0.0304	1863	0.0062	0.0039
1752	0.9528	0.9507	1790	0.3344	0.3190	1827	0.0290	0.0282	1864	0.0058	0.0037
1753	0.9572	0.9508	1791	0.3134	0.3026	1828	0.0268	0.0260	1865	0.0055	0.0036
1754	0.9605	0.9510	1792	0.2963	0.2862	1829	0.0246	0.0239	1866	0.0051	0.0035
1755	0.9638	0.9512	1793	0.2792	0.2698	1830	0.0224	0.0217	1867	0.0047	0.0034
1756	0.9645	0.9514	1794	0.2621	0.2533	1831	0.0208	0.0208	1868	0.0044	0.0033
1757	0.9635	0.9516	1795	0.2450	0.2369	1832	0.0208	0.0199	1869	0.0040	0.0033
1758	0.9624	0.9517	1796	0.2279	0.2204	1833	0.0202	0.0190	1870	0.0037	0.0032
1759	0.9614	0.9519	1797	0.2108	0.2040	1834	0.0197	0.0182	1871	0.0033	0.0031
1760	0.9604	0.9520	1798	0.1938	0.1875	1835	0.0191	0.0173	1872	0.0030	0.0030
1761	0.9570	0.9460	1799	0.1767	0.1710	1836	0.0186	0.0164	1873	0.0026	0.0028
1762	0.9527	0.9400	1800	0.1596	0.1546	1837	0.0180	0.0155	1874	0.0022	0.0027
1763	0.9483	0.9339	1801	0.1468	0.1462	1838	0.0175	0.0146	1875	0.0019	0.0026
1764	0.9440	0.9279	1802	0.1407	0.1378	1839	0.0169	0.0138	1876	0.0015	0.0025
1765	0.9397	0.9219	1803	0.1327	0.1294	1840	0.0164	0.0129	1877	0.0012	0.0024
1766	0.9307	0.9155	1804	0.1247	0.1210	1841	0.0158	0.0125	1878	0.0008	0.0023
1767	0.9197	0.9098	1805	0.1167	0.1127	1842	0.0153	0.0120	1879	0.0005	0.0022
1768	0.9088	0.9038	1806	0.1087	0.1044	1843	0.0147	0.0116	1880	0.0001	0.0021
1769	0.8978	0.8978	1807	0.1007	0.0960	1844	0.0142	0.0112	1881	.....	0.0019
1770	0.8865	0.8915	1808	0.0927	0.0877	1845	0.0142	0.0112	1882	.....	0.0017
1771	0.8679	0.8651	1809	0.0847	0.0794	1846	0.0137	0.0103	1883	.....	0.0015
1772	0.8457	0.8388	1810	0.0768	0.0712	1847	0.0131	0.0103	1884	.....	0.0013
1773	0.8235	0.8124	1811	0.0723	0.0684	1848	0.0126	0.0099	1885	.....	0.0010
1774	0.8012	0.7861	1812	0.0692	0.0657	1849	0.0120	0.0094	1886	.....	0.0008
1775	0.7790	0.7597	1813	0.0661	0.0629	1850	0.0115	0.0090	1887	.....	0.0006
1776	0.7522	0.7333	1814	0.0630	0.0601	1851	0.0109	0.0086	1888	.....	0.0004
1777	0.7234	0.7059	1815	0.0599	0.0574	1852	0.0105	0.0081	1889	0.0002
1778	0.6946	0.6806					0.0102	0.0077			

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Table A6
THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE BAND 7

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
1951	0.0002	0.0001	2011	0.0148	0.0151	2071	0.1600	0.1732	2131	0.9387	0.9670
1952	0.0003	0.0003	2012	0.0153	0.0156	2072	0.1701	0.1798	2132	0.9414	0.9120
1953	0.0005	0.0005	2013	0.0158	0.0160	2073	0.1802	0.1865	2133	0.9441	0.9170
1954	0.0007	0.0007	2014	0.0163	0.0165	2074	0.1903	0.1931	2134	0.9469	0.9219
1955	0.0009	0.0009	2015	0.0168	0.0170	2075	0.2004	0.1998	2135	0.9496	0.9269
1956	0.0010	0.0010	2016	0.0173	0.0175	2076	0.2105	0.2065	2136	0.9498	0.9319
1957	0.0012	0.0012	2017	0.0178	0.0180	2077	0.2207	0.2132	2137	0.9500	0.9369
1958	0.0014	0.0014	2018	0.0183	0.0185	2078	0.2309	0.2199	2138	0.9502	0.9419
1959	0.0016	0.0016	2019	0.0188	0.0190	2079	0.2410	0.2266	2139	0.9504	0.9469
1960	0.0017	0.0017	2020	0.0193	0.0194	2080	0.2512	0.2333	2140	0.9506	0.9519
1961	0.0019	0.0019	2021	0.0209	0.0207	2081	0.2654	0.2486	2141	0.9503	0.9519
1962	0.0021	0.0021	2022	0.0225	0.0219	2082	0.2797	0.2640	2142	0.9500	0.9518
1963	0.0023	0.0023	2023	0.0241	0.0231	2083	0.2940	0.2794	2143	0.9497	0.9517
1964	0.0025	0.0025	2024	0.0258	0.0244	2084	0.3084	0.2949	2144	0.9494	0.9517
1965	0.0026	0.0026	2025	0.0274	0.0256	2085	0.3227	0.3102	2145	0.9491	0.9516
1966	0.0028	0.0028	2026	0.0290	0.0269	2086	0.3371	0.3258	2146	0.9484	0.9515
1967	0.0030	0.0030	2027	0.0307	0.0281	2087	0.3515	0.3413	2147	0.9477	0.9515
1968	0.0032	0.0032	2028	0.0323	0.0294	2088	0.3659	0.3568	2148	0.9471	0.9514
1969	0.0034	0.0034	2029	0.0340	0.0306	2089	0.3803	0.3723	2149	0.9464	0.9513
1970	0.0036	0.0036	2030	0.0356	0.0319	2090	0.3947	0.3878	2150	0.9457	0.9512
1971	0.0037	0.0037	2031	0.0373	0.0331	2091	0.4092	0.4034	2151	0.9450	0.9512
1972	0.0039	0.0039	2032	0.0389	0.0344	2092	0.4237	0.4190	2152	0.9443	0.9511
1973	0.0041	0.0041	2033	0.0406	0.0356	2093	0.4382	0.4346	2153	0.9435	0.9510
1974	0.0043	0.0043	2034	0.0423	0.0367	2094	0.4528	0.4502	2154	0.9421	0.9509
1975	0.0045	0.0045	2035	0.0439	0.0381	2095	0.4673	0.4658	2155	0.9417	0.9509
1976	0.0047	0.0047	2036	0.0456	0.0394	2096	0.4819	0.4814	2156	0.9412	0.9508
1977	0.0049	0.0049	2037	0.0473	0.0407	2097	0.4965	0.4971	2157	0.9407	0.9507
1978	0.0050	0.0050	2038	0.0489	0.0419	2098	0.5111	0.5128	2158	0.9403	0.9506
1979	0.0052	0.0052	2039	0.0506	0.0432	2099	0.5257	0.5285	2159	0.9398	0.9505
1980	0.0054	0.0054	2040	0.0523	0.0445	2100	0.5404	0.5432	2160	0.9393	0.9505
1981	0.0056	0.0056	2041	0.0540	0.0472	2101	0.5557	0.5592	2161	0.9386	0.9505
1982	0.0058	0.0058	2042	0.0557	0.0500	2102	0.5710	0.5744	2162	0.9378	0.9504
1983	0.0060	0.0060	2043	0.0574	0.0527	2103	0.5864	0.5906	2163	0.9373	0.9503
1984	0.0062	0.0062	2044	0.0591	0.0555	2104	0.6018	0.6048	2164	0.9366	0.9502
1985	0.0064	0.0064	2045	0.0608	0.0583	2105	0.6172	0.6200	2165	0.9360	0.9501
1986	0.0066	0.0066	2046	0.0625	0.0611	2106	0.6327	0.6353	2166	0.9357	0.9500
1987	0.0068	0.0068	2047	0.0642	0.0638	2107	0.6482	0.6506	2167	0.9354	0.9500
1988	0.0070	0.0070	2048	0.0659	0.0666	2108	0.6637	0.6659	2168	0.9352	0.9500
1989	0.0072	0.0072	2049	0.0676	0.0694	2109	0.6792	0.6813	2169	0.9350	0.9500
1990	0.0074	0.0074	2050	0.0693	0.0722	2110	0.6948	0.6967	2170	0.9347	0.9500
1991	0.0076	0.0076	2051	0.0710	0.0750	2111	0.7104	0.7121	2171	0.9344	0.9499
1992	0.0078	0.0078	2052	0.0727	0.0778	2112	0.7261	0.7276	2172	0.9341	0.9498
1993	0.0080	0.0080	2053	0.0743	0.0805	2113	0.7418	0.7431	2173	0.9338	0.9497
1994	0.0082	0.0082	2054	0.0760	0.0834	2114	0.7575	0.7587	2174	0.9335	0.9496
1995	0.0084	0.0084	2055	0.0777	0.0862	2115	0.7733	0.7743	2175	0.9332	0.9495
1996	0.0086	0.0086	2056	0.0794	0.0891	2116	0.7891	0.7899	2176	0.9329	0.9494
1997	0.0088	0.0088	2057	0.0811	0.0919	2117	0.8050	0.8056	2177	0.9326	0.9493
1998	0.0090	0.0090	2058	0.0828	0.0947	2118	0.8209	0.8213	2178	0.9323	0.9492
1999	0.0092	0.0092	2059	0.0845	0.0975	2119	0.8368	0.8370	2179	0.9320	0.9491
2000	0.0094	0.0094	2060	0.0862	0.0995	2120	0.8527	0.8529	2180	0.9317	0.9490
2001	0.0096	0.0096	2061	0.0879	0.1015	2121	0.8686	0.8687	2181	0.9314	0.9489
2002	0.0098	0.0098	2062	0.0896	0.1035	2122	0.8845	0.8846	2182	0.9311	0.9488
2003	0.0100	0.0100	2063	0.0913	0.1055	2123	0.9004	0.9004	2183	0.9308	0.9487
2004	0.0102	0.0102	2064	0.0930	0.1075	2124	0.9163	0.9163	2184	0.9305	0.9486
2005	0.0104	0.0104	2065	0.0947	0.1095	2125	0.9322	0.9322	2185	0.9302	0.9485
2006	0.0106	0.0106	2066	0.0964	0.1115	2126	0.9481	0.9481	2186	0.9299	0.9484
2007	0.0108	0.0108	2067	0.0981	0.1135	2127	0.9640	0.9640	2187	0.9296	0.9483
2008	0.0110	0.0110	2068	0.0998	0.1155	2128	0.9799	0.9799	2188	0.9293	0.9482
2009	0.0112	0.0112	2069	0.0116	0.1175	2129	0.9958	0.9958	2189	0.9290	0.9481
2010	0.0114	0.0114	2070	0.0132	0.1195	2130	1.0117	1.0117	2190	0.9287	0.9480

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Table A6
(CONTINUED)

WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F
2191	0.9996	0.9976	2246	0.9300	0.9348	2301	0.7514	0.7523	2356	0.2964	0.3060
2192	1.0000	0.9979	2247	0.9281	0.9347	2302	0.7455	0.7561	2357	0.2738	0.2781
2193	0.9994	0.9982	2248	0.9261	0.9345	2303	0.7396	0.7598	2358	0.2512	0.2502
2194	0.9989	0.9984	2249	0.9242	0.9342	2304	0.7337	0.7636	2359	0.2286	0.2223
2195	0.9983	0.9987	2250	0.9223	0.9342	2305	0.7278	0.7673	2360	0.2060	0.1943
2196	0.9977	0.9989	2251	0.9204	0.9340	2306	0.7219	0.7710	2361	0.1835	0.1756
2197	0.9972	0.9992	2252	0.9185	0.9338	2307	0.7160	0.7748	2362	0.1610	0.1774
2198	0.9966	0.9995	2253	0.9166	0.9336	2308	0.7101	0.7785	2363	0.1385	0.1692
2199	0.9960	0.9997	2254	0.9147	0.9335	2309	0.7042	0.7822	2364	0.1160	0.1609
2200	0.9954	1.0000	2255	0.9128	0.9333	2310	0.6983	0.7860	2365	0.0935	0.1526
2201	0.9952	0.9996	2256	0.9109	0.9331	2311	0.6924	0.7897	2366	0.0710	0.1444
2202	0.9949	0.9991	2257	0.9090	0.9329	2312	0.6865	0.7935	2367	0.0485	0.1361
2203	0.9946	0.9987	2258	0.9071	0.9328	2313	0.6806	0.7972	2368	0.0260	0.1278
2204	0.9943	0.9983	2259	0.9052	0.9326	2314	0.6747	0.8009	2369	0.0035	0.1195
2205	0.9940	0.9978	2260	0.9033	0.9324	2315	0.6688	0.8047	2370	0.0010	0.1112
2206	0.9937	0.9974	2261	0.9014	0.9322	2316	0.6629	0.8084	2371	0.0010	0.1028
2207	0.9934	0.9970	2262	0.9014	0.9320	2317	0.6570	0.8121	2372	0.0010	0.0945
2208	0.9931	0.9965	2263	0.9014	0.9318	2318	0.6511	0.8159	2373	0.0010	0.0862
2209	0.9928	0.9961	2264	0.9014	0.9316	2319	0.6452	0.8196	2374	0.0010	0.0778
2210	0.9925	0.9956	2265	0.9014	0.9314	2320	0.6393	0.8233	2375	0.0010	0.0694
2211	0.9922	0.9952	2266	0.9014	0.9312	2321	0.6334	0.8270	2376	0.0010	0.0611
2212	0.9919	0.9948	2267	0.9014	0.9310	2322	0.6275	0.8307	2377	0.0010	0.0527
2213	0.9916	0.9943	2268	0.9014	0.9308	2323	0.6216	0.8344	2378	0.0010	0.0443
2214	0.9913	0.9939	2269	0.9014	0.9306	2324	0.6157	0.8381	2379	0.0010	0.0359
2215	0.9910	0.9934	2270	0.9014	0.9304	2325	0.6098	0.8418	2380	0.0010	0.0274
2216	0.9907	0.9930	2271	0.9014	0.9302	2326	0.6039	0.8455	2381	0.0010	0.0190
2217	0.9904	0.9926	2272	0.9014	0.9300	2327	0.5980	0.8492	2382	0.0010	0.0106
2218	0.9901	0.9921	2273	0.9014	0.9298	2328	0.5921	0.8529	2383	0.0010	0.0022
2219	0.9898	0.9917	2274	0.8995	0.9296	2329	0.5862	0.8566	2384	0.0010	0.0010
2220	0.9895	0.9912	2275	0.8976	0.9294	2330	0.5803	0.8603	2385	0.0010	0.0010
2221	0.9891	0.9908	2276	0.8957	0.9292	2331	0.5744	0.8640	2386	0.0010	0.0010
2222	0.9886	0.9903	2277	0.8938	0.9290	2332	0.5685	0.8677	2387	0.0010	0.0010
2223	0.9882	0.9900	2278	0.8919	0.9288	2333	0.5626	0.8714	2388	0.0010	0.0010
2224	0.9877	0.9897	2279	0.8900	0.9286	2334	0.5567	0.8751	2389	0.0010	0.0010
2225	0.9872	0.9892	2280	0.8881	0.9284	2335	0.5508	0.8788	2390	0.0010	0.0010
2226	0.9868	0.9888	2281	0.8862	0.9282	2336	0.5449	0.8825	2391	0.0010	0.0010
2227	0.9863	0.9883	2282	0.8843	0.9280	2337	0.5390	0.8862	2392	0.0010	0.0010
2228	0.9859	0.9879	2283	0.8824	0.9278	2338	0.5331	0.8899	2393	0.0010	0.0010
2229	0.9854	0.9874	2284	0.8805	0.9276	2339	0.5272	0.8936	2394	0.0010	0.0010
2230	0.9850	0.9870	2285	0.8786	0.9274	2340	0.5213	0.8973	2395	0.0010	0.0010
2231	0.9846	0.9866	2286	0.8767	0.9272	2341	0.5154	0.9010	2396	0.0010	0.0010
2232	0.9841	0.9861	2287	0.8748	0.9270	2342	0.5095	0.9047	2397	0.0010	0.0010
2233	0.9837	0.9857	2288	0.8729	0.9268	2343	0.5036	0.9084	2398	0.0010	0.0010
2234	0.9832	0.9852	2289	0.8710	0.9266	2344	0.4977	0.9121	2399	0.0010	0.0010
2235	0.9828	0.9848	2290	0.8691	0.9264	2345	0.4918	0.9158	2400	0.0010	0.0010
2236	0.9823	0.9843	2291	0.8672	0.9262	2346	0.4859	0.9195	2401	0.0010	0.0010
2237	0.9819	0.9839	2292	0.8653	0.9260	2347	0.4800	0.9232	2402	0.0010	0.0010
2238	0.9814	0.9834	2293	0.8634	0.9258	2348	0.4741	0.9269	2403	0.0010	0.0010
2239	0.9810	0.9830	2294	0.8615	0.9256	2349	0.4682	0.9306	2404	0.0010	0.0010
2240	0.9805	0.9825	2295	0.8596	0.9254	2350	0.4623	0.9343	2405	0.0010	0.0010
2241	0.9801	0.9821	2296	0.8577	0.9252	2351	0.4564	0.9380	2406	0.0010	0.0010
2242	0.9796	0.9816	2297	0.8558	0.9250	2352	0.4505	0.9417	2407	0.0010	0.0010
2243	0.9792	0.9812	2298	0.8539	0.9248	2353	0.4446	0.9454	2408	0.0010	0.0010
2244	0.9787	0.9807	2299	0.8520	0.9246	2354	0.4387	0.9491	2409	0.0010	0.0010
2245	0.9783	0.9803	2300	0.8501	0.9244	2355	0.4328	0.9528			

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Table A7a
THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE - BAND G --- DETECTOR 1

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
9760	0.0004	0.2209	10360	0.2821	0.8613	11560	0.5421	0.9636
9770	0.0008	0.2461	10370	0.3157	0.8661	11570	0.5311	0.9575
9780	0.0011	0.2715	10380	0.3495	0.8709	11580	0.5203	0.9515
9790	0.0015	0.2971	10390	0.3835	0.8758	11590	0.5095	0.9454
9800	0.0019	0.3230	10400	0.4184	0.8805	11600	0.5003	0.9393
9810	0.0023	0.3566	10410	0.4535	0.8852	11610	0.4912	0.9303
9820	0.0027	0.3903	10420	0.4920	0.8898	11620	0.4820	0.9212
9830	0.0031	0.4241	10430	0.5378	0.8859	11630	0.4730	0.9122
9840	0.0035	0.4581	10440	0.5839	0.8815	11640	0.4643	0.9031
9850	0.0038	0.4922	10450	0.6306	0.8772	11650	0.4562	0.8940
9860	0.0042	0.5263	10460	0.6777	0.8730	11660	0.4488	0.8849
9870	0.0046	0.5606	10470	0.7252	0.8685	11670	0.4411	0.8758
9880	0.0050	0.5950	10480	0.7732	0.8643	11680	0.4336	0.8667
9890	0.0054	0.6295	10490	0.8215	0.8600	11690	0.4262	0.8576
9900	0.0058	0.6641	10500	0.8700	0.8558	11700	0.4188	0.8485
9910	0.0062	0.6988	10510	0.9185	0.8515	11710	0.4115	0.8394
9920	0.0066	0.7336	10520	0.9670	0.8472	11720	0.4042	0.8303
9930	0.0070	0.7683	10530	1.0155	0.8430	11730	0.3969	0.8212
9940	0.0074	0.8030	10540	1.0640	0.8387	11740	0.3896	0.8121
9950	0.0078	0.8377	10550	1.1125	0.8345	11750	0.3823	0.8030
9960	0.0082	0.8724	10560	1.1610	0.8303	11760	0.3750	0.7939
9970	0.0086	0.9071	10570	1.2095	0.8260	11770	0.3677	0.7848
9980	0.0090	0.9418	10580	1.2580	0.8218	11780	0.3604	0.7757
9990	0.0094	0.9765	10590	1.3065	0.8175	11790	0.3531	0.7666
10000	0.0098	1.0112	10600	1.3550	0.8133	11800	0.3458	0.7575
10010	0.0101	1.0459	10610	1.4035	0.8090	11810	0.3385	0.7484
10020	0.0105	1.0806	10620	1.4520	0.8048	11820	0.3312	0.7393
10030	0.0109	1.1153	10630	1.5005	0.8005	11830	0.3239	0.7302
10040	0.0113	1.1500	10640	1.5490	0.7963	11840	0.3166	0.7211
10050	0.0117	1.1847	10650	1.5975	0.7920	11850	0.3093	0.7120
10060	0.0121	1.2194	10660	1.6460	0.7878	11860	0.3020	0.7029
10070	0.0125	1.2541	10670	1.6945	0.7835	11870	0.2947	0.6938
10080	0.0129	1.2888	10680	1.7430	0.7793	11880	0.2874	0.6847
10090	0.0133	1.3235	10690	1.7915	0.7750	11890	0.2801	0.6756
10100	0.0136	1.3582	10700	1.8400	0.7708	11900	0.2728	0.6665
10110	0.0140	1.3929	10710	1.8885	0.7665	11910	0.2655	0.6574
10120	0.0144	1.4276	10720	1.9370	0.7623	11920	0.2582	0.6483
10130	0.0148	1.4623	10730	1.9855	0.7580	11930	0.2509	0.6392
10140	0.0152	1.4970	10740	2.0340	0.7538	11940	0.2436	0.6301
10150	0.0156	1.5317	10750	2.0825	0.7495	11950	0.2363	0.6210
10160	0.0160	1.5664	10760	2.1310	0.7453	11960	0.2290	0.6119
10170	0.0164	1.6011	10770	2.1795	0.7410	11970	0.2217	0.6028
10180	0.0168	1.6358	10780	2.2280	0.7368	11980	0.2144	0.5937
10190	0.0172	1.6705	10790	2.2765	0.7325	11990	0.2071	0.5846
10200	0.0176	1.7052	10800	2.3250	0.7283	12000	0.1998	0.5755
10210	0.0180	1.7399	10810	2.3735	0.7240	12010	0.1925	0.5664
10220	0.0184	1.7746	10820	2.4220	0.7198	12020	0.1852	0.5573
10230	0.0188	1.8093	10830	2.4705	0.7155	12030	0.1779	0.5482
10240	0.0192	1.8440	10840	2.5190	0.7113	12040	0.1706	0.5391
10250	0.0196	1.8787	10850	2.5675	0.7070	12050	0.1633	0.5300
10260	0.0200	1.9134	10860	2.6160	0.7028	12060	0.1560	0.5209
10270	0.0204	1.9481	10870	2.6645	0.6985	12070	0.1487	0.5118
10280	0.0208	1.9828	10880	2.7130	0.6943	12080	0.1414	0.5027
10290	0.0212	2.0175	10890	2.7615	0.6900	12090	0.1341	0.4936
10300	0.0216	2.0522	10900	2.8100	0.6858	12100	0.1268	0.4845
10310	0.0220	2.0869	10910	2.8585	0.6815	12110	0.1195	0.4754
10320	0.0224	2.1216	10920	2.9070	0.6773	12120	0.1122	0.4663
10330	0.0228	2.1563	10930	2.9555	0.6730	12130	0.1049	0.4572
10340	0.0232	2.1910	10940	3.0040	0.6688	12140	0.0976	0.4481
10350	0.0236	2.2257	10950	3.0525	0.6645	12150	0.0903	0.4390

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Table A7a
(CONTINUED)

WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F
12160	0.1372	0.8907	12380	0.0707	0.5991	12600	0.0034	0.0422	12820	0.0005	0.0076
12170	0.1454	0.8891	12390	0.0656	0.5721	12610	0.0032	0.0400	12830	0.0005	0.0073
12180	0.1437	0.8875	12400	0.0606	0.5451	12620	0.0030	0.0377	12840	0.0004	0.0070
12190	0.1419	0.8859	12410	0.0561	0.5149	12630	0.0028	0.0356	12850	0.0004	0.0067
12200	0.1396	0.8843	12420	0.0517	0.4846	12640	0.0026	0.0334	12860	0.0004	0.0064
12210	0.1371	0.8774	12430	0.0473	0.4543	12650	0.0024	0.0312	12870	0.0004	0.0061
12220	0.1346	0.8706	12440	0.0430	0.4238	12660	0.0022	0.0291	12880	0.0004	0.0058
12230	0.1320	0.8638	12450	0.0389	0.3934	12670	0.0020	0.0270	12890	0.0003	0.0055
12240	0.1295	0.8571	12460	0.0349	0.3628	12680	0.0018	0.0248	12900	0.0003	0.0051
12250	0.1269	0.8503	12470	0.0311	0.3322	12690	0.0016	0.0226	12910	0.0003	0.0047
12260	0.1244	0.8435	12480	0.0274	0.3015	12700	0.0015	0.0207	12920	0.0002	0.0043
12270	0.1219	0.8368	12490	0.0238	0.2708	12710	0.0014	0.0194	12930	0.0002	0.0039
12280	0.1197	0.8301	12500	0.0205	0.2400	12720	0.0013	0.0182	12940	0.0002	0.0035
12290	0.1174	0.8234	12510	0.0186	0.2197	12730	0.0012	0.0170	12950	0.0002	0.0031
12300	0.1092	0.8166	12520	0.0167	0.1986	12740	0.0011	0.0157	12960	0.0001	0.0026
12310	0.1051	0.7893	12530	0.0149	0.1795	12750	0.0010	0.0145	12970	0.0001	0.0022
12320	0.1006	0.7620	12540	0.0130	0.1596	12760	0.0009	0.0132	12980	0.0001	0.0018
12330	0.0963	0.7347	12550	0.0112	0.1397	12770	0.0008	0.0120	12990	0.0001	0.0014
12340	0.0921	0.7075	12560	0.0095	0.1200	12780	0.0007	0.0107	13000	0.0001	0.0010
12350	0.0872	0.6803	12570	0.0077	0.1004	12790	0.0006	0.0095	13010	0.0000	0.0000
12360	0.0815	0.6532	12580	0.0061	0.0808	12800	0.0005	0.0083	13020	0.0000	0.0000
12370	0.0760	0.6261	12590	0.0047	0.0614	12810	0.0005	0.0079			

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Table A7b

THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE BAND 6 - - - DETECTOR 2

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
9760	0.0004	0.0000	10360	0.2893	0.2256	10960	0.9314	0.3479	11560	0.5876	0.9524
9770	0.0008	0.0000	10370	0.3237	0.2511	10970	0.9934	0.9537	11570	0.5761	0.9446
9780	0.002	0.0000	10380	0.3585	0.2769	10980	0.9951	0.9614	11580	0.5649	0.9368
9790	0.0015	0.0000	10390	0.3934	0.3029	10990	0.9969	0.9683	11590	0.5537	0.9290
9800	0.0019	0.0000	10400	0.4290	0.3292	11000	0.9988	0.9751	11600	0.5422	0.9213
9810	0.0023	0.0000	10410	0.4648	0.3633	11010	0.9990	0.9759	11610	0.5309	0.9135
9820	0.0027	0.0000	10420	0.5042	0.3974	11020	0.9992	0.9768	11620	0.5197	0.9057
9830	0.0031	0.0000	10430	0.5506	0.4317	11030	0.9995	0.9776	11630	0.5087	0.8979
9840	0.0035	0.0000	10440	0.5974	0.4661	11040	0.9997	0.9784	11640	0.4994	0.8901
9850	0.0039	0.0000	10450	0.6447	0.5005	11050	1.0000	0.9793	11650	0.4900	0.8823
9860	0.0043	0.0000	10460	0.6923	0.5350	11060	0.9978	0.9801	11660	0.4807	0.8745
9870	0.0047	0.0000	10470	0.7403	0.5696	11070	0.9956	0.9809	11670	0.4715	0.8667
9880	0.0051	0.0000	10480	0.7883	0.6043	11080	0.9934	0.9818	11680	0.4623	0.8589
9890	0.0055	0.0000	10490	0.8363	0.6391	11090	0.9912	0.9826	11690	0.4539	0.8511
9900	0.0059	0.0000	10500	0.8843	0.6739	11100	0.9890	0.9834	11700	0.4460	0.8433
9910	0.0063	0.0000	10510	0.9323	0.7087	11110	0.9868	0.9842	11710	0.4381	0.8355
9920	0.0067	0.0000	10520	0.9803	0.7435	11120	0.9846	0.9850	11720	0.4302	0.8277
9930	0.0071	0.0000	10530	0.9709	0.7042	11130	0.9824	0.9858	11730	0.4223	0.8199
9940	0.0075	0.0000	10540	0.9615	0.7145	11140	0.9802	0.9866	11740	0.4145	0.8121
9950	0.0080	0.0000	10550	0.9521	0.7248	11150	0.9780	0.9874	11750	0.4066	0.8043
9960	0.0084	0.0000	10560	0.9427	0.7351	11160	0.9758	0.9882	11760	0.3988	0.7965
9970	0.0088	0.0000	10570	0.9333	0.7454	11170	0.9736	0.9890	11770	0.3910	0.7887
9980	0.0092	0.0000	10580	0.9239	0.7557	11180	0.9714	0.9898	11780	0.3832	0.7809
9990	0.0096	0.0000	10590	0.9145	0.7660	11190	0.9692	0.9906	11790	0.3754	0.7731
10000	0.0100	0.0000	10600	0.9051	0.7763	11200	0.9670	0.9914	11800	0.3676	0.7653
10010	0.0104	0.0000	10610	0.8957	0.7866	11210	0.9648	0.9922	11810	0.3598	0.7575
10020	0.0108	0.0000	10620	0.8863	0.7969	11220	0.9626	0.9930	11820	0.3520	0.7497
10030	0.0112	0.0000	10630	0.8769	0.8072	11230	0.9604	0.9938	11830	0.3442	0.7419
10040	0.0116	0.0000	10640	0.8675	0.8175	11240	0.9582	0.9946	11840	0.3364	0.7341
10050	0.0120	0.0000	10650	0.8581	0.8278	11250	0.9560	0.9954	11850	0.3286	0.7263
10060	0.0124	0.0000	10660	0.8487	0.8381	11260	0.9538	0.9962	11860	0.3208	0.7185
10070	0.0128	0.0000	10670	0.8393	0.8484	11270	0.9516	0.9970	11870	0.3130	0.7107
10080	0.0132	0.0000	10680	0.8299	0.8587	11280	0.9494	0.9978	11880	0.3052	0.7029
10090	0.0136	0.0000	10690	0.8205	0.8690	11290	0.9472	0.9986	11890	0.2974	0.6951
10100	0.0140	0.0000	10700	0.8111	0.8793	11300	0.9450	0.9994	11900	0.2896	0.6873
10110	0.0144	0.0000	10710	0.8017	0.8896	11310	0.9428	0.9992	11910	0.2818	0.6795
10120	0.0148	0.0000	10720	0.7923	0.8999	11320	0.9406	0.9990	11920	0.2740	0.6717
10130	0.0152	0.0000	10730	0.7829	0.9102	11330	0.9384	0.9998	11930	0.2662	0.6639
10140	0.0156	0.0000	10740	0.7735	0.9205	11340	0.9362	0.9996	11940	0.2584	0.6561
10150	0.0160	0.0000	10750	0.7641	0.9308	11350	0.9340	0.9994	11950	0.2506	0.6483
10160	0.0164	0.0000	10760	0.7547	0.9411	11360	0.9318	0.9992	11960	0.2428	0.6405
10170	0.0168	0.0000	10770	0.7453	0.9514	11370	0.9296	0.9990	11970	0.2350	0.6327
10180	0.0172	0.0000	10780	0.7359	0.9617	11380	0.9274	0.9988	11980	0.2272	0.6249
10190	0.0176	0.0000	10790	0.7265	0.9720	11390	0.9252	0.9986	11990	0.2194	0.6171
10200	0.0180	0.0000	10800	0.7171	0.9823	11400	0.9230	0.9984	12000	0.2116	0.6093
10210	0.0184	0.0000	10810	0.7077	0.9926	11410	0.9208	0.9982	12010	0.2038	0.6015
10220	0.0188	0.0000	10820	0.6983	0.9989	11420	0.9186	0.9980	12020	0.1960	0.5937
10230	0.0192	0.0000	10830	0.6889	0.9992	11430	0.9164	0.9978	12030	0.1882	0.5859
10240	0.0196	0.0000	10840	0.6795	0.9995	11440	0.9142	0.9976	12040	0.1804	0.5781
10250	0.0200	0.0000	10850	0.6701	0.9998	11450	0.9120	0.9974	12050	0.1726	0.5703
10260	0.0204	0.0000	10860	0.6607	0.9999	11460	0.9098	0.9972	12060	0.1648	0.5625
10270	0.0208	0.0000	10870	0.6513	0.9999	11470	0.9076	0.9970	12070	0.1570	0.5547
10280	0.0212	0.0000	10880	0.6419	0.9999	11480	0.9054	0.9968	12080	0.1492	0.5469
10290	0.0216	0.0000	10890	0.6325	0.9999	11490	0.9032	0.9966	12090	0.1414	0.5391
10300	0.0220	0.0000	10900	0.6231	0.9999	11500	0.9010	0.9964	12100	0.1336	0.5313
10310	0.0224	0.0000	10910	0.6137	0.9999	11510	0.8988	0.9962	12110	0.1258	0.5235
10320	0.0228	0.0000	10920	0.6043	0.9999	11520	0.8966	0.9960	12120	0.1180	0.5157
10330	0.0232	0.0000	10930	0.5949	0.9999	11530	0.8944	0.9958	12130	0.1102	0.5079
10340	0.0236	0.0000	10940	0.5855	0.9999	11540	0.8922	0.9956	12140	0.1024	0.5001
10350	0.0240	0.0000	10950	0.5761	0.9999	11550	0.8900	0.9954	12150	0.0946	0.4923

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Table A7b
(CONTINUED)

WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F
12160	0.1732	0.9602	12380	0.0814	0.6523	12600	0.0038	0.0458	12820	0.0005	0.0981
12170	0.1710	0.9589	12390	0.0754	0.6332	12610	0.0036	0.0433	12830	0.0005	0.0978
12180	0.1688	0.9577	12400	0.0696	0.5940	12620	0.0033	0.0409	12840	0.0005	0.0974
12190	0.1665	0.9564	12410	0.0643	0.5614	12630	0.0031	0.0385	12850	0.0004	0.0971
12200	0.1638	0.9551	12420	0.0591	0.5286	12640	0.0028	0.0361	12860	0.0004	0.0968
12210	0.1607	0.9481	12430	0.0540	0.4957	12650	0.0026	0.0337	12870	0.0004	0.0964
12220	0.1576	0.9412	12440	0.0490	0.4627	12660	0.0024	0.0314	12880	0.0003	0.0961
12230	0.1545	0.9343	12450	0.0442	0.4296	12670	0.0022	0.0291	12890	0.0003	0.0958
12240	0.1514	0.9274	12460	0.0395	0.3964	12680	0.0020	0.0268	12900	0.0003	0.0954
12250	0.1483	0.9205	12470	0.0352	0.3631	12690	0.0018	0.0245	12910	0.0003	0.0950
12260	0.1452	0.9136	12480	0.0309	0.3297	12700	0.0016	0.0223	12920	0.0003	0.0941
12270	0.1422	0.9067	12490	0.0269	0.2962	12710	0.0015	0.0209	12930	0.0002	0.0937
12280	0.1372	0.8999	12500	0.0230	0.2627	12720	0.0014	0.0195	12940	0.0002	0.0932
12290	0.1320	0.8930	12510	0.0209	0.2403	12730	0.0013	0.0182	12950	0.0002	0.0928
12300	0.1270	0.8861	12520	0.0187	0.2181	12740	0.0012	0.0168	12960	0.0002	0.0923
12310	0.1220	0.8568	12530	0.0166	0.1960	12750	0.0011	0.0155	12970	0.0001	0.0919
12320	0.1168	0.8275	12540	0.0146	0.1741	12760	0.0010	0.0141	12980	0.0001	0.0915
12330	0.1116	0.7982	12550	0.0126	0.1523	12770	0.0009	0.0128	12990	0.0001	0.0911
12340	0.1066	0.7690	12560	0.0106	0.1307	12780	0.0008	0.0115	13000	0.0000	0.0900
12350	0.1009	0.7398	12570	0.0086	0.1092	12790	0.0007	0.0101	13010	0.0000	0.0898
12360	0.0941	0.7136	12580	0.0068	0.0879	12800	0.0005	0.0088	13020	0.0000	0.0895
12370	0.0877	0.6814	12590	0.0053	0.0667	12810	0.0006	0.0086			

ORIGINAL PAGE IS
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Table A7c

THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE

RAND G --- DETECTOR 3

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
9760	0.0004	.....	10360	0.2830	0.2209	10960	0.9906	0.8613	11560	0.6197	0.9636
9770	0.0008	.....	10370	0.3167	0.2461	10970	0.9927	0.8651	11570	0.6072	0.9575
9780	0.0011	.....	10380	0.3507	0.2715	10980	0.9947	0.8703	11580	0.5950	0.9515
9790	0.0015	.....	10390	0.3849	0.2971	10990	0.9967	0.8758	11590	0.5829	0.9454
9800	0.0019	.....	10400	0.4203	0.3230	11000	0.9988	0.8806	11600	0.5706	0.9393
9810	0.0023	.....	10410	0.4561	0.3566	11010	0.9970	0.8832	11610	0.5583	0.9303
9820	0.0027	.....	10420	0.4934	0.3903	11020	0.9932	0.8859	11620	0.5462	0.9212
9830	0.0031	.....	10430	0.5315	0.4241	11030	0.9995	0.8885	11630	0.5344	0.9122
9840	0.0035	.....	10440	0.5680	0.4581	11040	0.9997	0.8912	11640	0.5242	0.9031
9850	0.0038	.....	10450	0.6050	0.4922	11050	1.0000	0.8938	11650	0.5141	0.8940
9860	0.0042	.....	10460	0.6425	0.5263	11060	0.9988	0.8965	11660	0.5040	0.8849
9870	0.0046	.....	10470	0.6804	0.5606	11070	0.9976	0.8991	11670	0.4940	0.8758
9880	0.0050	.....	10480	0.7186	0.5950	11080	0.9964	0.9018	11680	0.4840	0.8667
9890	0.0054	.....	10490	0.7566	0.6295	11090	0.9936	0.9044	11690	0.4748	0.8576
9900	0.0058	.....	10500	0.7947	0.6641	11100	0.9908	0.9071	11700	0.4653	0.8485
9910	0.0062	.....	10510	0.8326	0.6982	11110	0.9835	0.9054	11710	0.4554	0.8391
9920	0.0066	.....	10520	0.8704	0.7326	11120	0.9717	0.9036	11720	0.4451	0.8296
9930	0.0070	.....	10530	0.9083	0.7668	11130	0.9597	0.9019	11730	0.4357	0.8202
9940	0.0074	.....	10540	0.9462	0.8008	11140	0.9478	0.9002	11740	0.4262	0.8107
9950	0.0078	.....	10550	0.9841	0.8348	11150	0.9360	0.9034	11750	0.4167	0.8013
9960	0.0082	.....	10560	1.0220	0.8685	11160	0.9243	0.9026	11760	0.4072	0.7918
9970	0.0086	.....	10570	1.0600	0.9024	11170	0.9126	0.9019	11770	0.3977	0.7823
9980	0.0090	.....	10580	1.0979	0.9364	11180	0.9010	0.9011	11780	0.3882	0.7728
9990	0.0094	.....	10590	1.1358	0.9704	11190	0.8895	0.9003	11790	0.3787	0.7633
10000	0.0098	.....	10600	1.1737	1.0044	11200	0.8781	0.8995	11800	0.3692	0.7538
10010	0.0102	.....	10610	1.2116	1.0384	11210	0.8667	0.8987	11810	0.3597	0.7443
10020	0.0106	.....	10620	1.2495	1.0724	11220	0.8552	0.8979	11820	0.3502	0.7348
10030	0.0110	.....	10630	1.2874	1.1062	11230	0.8437	0.8971	11830	0.3407	0.7253
10040	0.0114	.....	10640	1.3253	1.1400	11240	0.8322	0.8963	11840	0.3312	0.7158
10050	0.0118	.....	10650	1.3632	1.1738	11250	0.8207	0.8955	11850	0.3217	0.7063
10060	0.0122	.....	10660	1.4011	1.2076	11260	0.8092	0.8947	11860	0.3122	0.6968
10070	0.0126	.....	10670	1.4390	1.2414	11270	0.7977	0.8939	11870	0.3027	0.6873
10080	0.0130	.....	10680	1.4769	1.2752	11280	0.7862	0.8931	11880	0.2932	0.6778
10090	0.0134	.....	10690	1.5148	1.3090	11290	0.7747	0.8923	11890	0.2837	0.6683
10100	0.0138	.....	10700	1.5527	1.3428	11300	0.7632	0.8915	11900	0.2742	0.6588
10110	0.0142	.....	10710	1.5906	1.3766	11310	0.7517	0.8907	11910	0.2647	0.6493
10120	0.0146	.....	10720	1.6285	1.4104	11320	0.7402	0.8899	11920	0.2552	0.6398
10130	0.0150	.....	10730	1.6664	1.4442	11330	0.7287	0.8891	11930	0.2457	0.6303
10140	0.0154	.....	10740	1.7043	1.4780	11340	0.7172	0.8883	11940	0.2362	0.6208
10150	0.0158	.....	10750	1.7422	1.5118	11350	0.7057	0.8875	11950	0.2267	0.6113
10160	0.0162	.....	10760	1.7801	1.5456	11360	0.6942	0.8867	11960	0.2172	0.6018
10170	0.0166	.....	10770	1.8180	1.5794	11370	0.6827	0.8859	11970	0.2077	0.5923
10180	0.0170	.....	10780	1.8559	1.6132	11380	0.6712	0.8851	11980	0.1982	0.5828
10190	0.0174	.....	10790	1.8938	1.6470	11390	0.6597	0.8843	11990	0.1887	0.5733
10200	0.0178	.....	10800	1.9317	1.6808	11400	0.6482	0.8835	12000	0.1792	0.5638
10210	0.0182	.....	10810	1.9696	1.7146	11410	0.6367	0.8827	12010	0.1697	0.5543
10220	0.0186	.....	10820	2.0075	1.7484	11420	0.6252	0.8819	12020	0.1602	0.5448
10230	0.0190	.....	10830	2.0454	1.7822	11430	0.6137	0.8811	12030	0.1507	0.5353
10240	0.0194	.....	10840	2.0833	1.8160	11440	0.6022	0.8803	12040	0.1412	0.5258
10250	0.0198	.....	10850	2.1212	1.8498	11450	0.5907	0.8795	12050	0.1317	0.5163
10260	0.0202	.....	10860	2.1591	1.8836	11460	0.5792	0.8787	12060	0.1222	0.5068
10270	0.0206	.....	10870	2.1970	1.9174	11470	0.5677	0.8779	12070	0.1127	0.4973
10280	0.0210	.....	10880	2.2349	1.9512	11480	0.5562	0.8771	12080	0.1032	0.4878
10290	0.0214	.....	10890	2.2728	1.9850	11490	0.5447	0.8763	12090	0.0937	0.4783
10300	0.0218	.....	10900	2.3107	2.0188	11500	0.5332	0.8755	12100	0.0842	0.4688
10310	0.0222	.....	10910	2.3486	2.0526	11510	0.5217	0.8747	12110	0.0747	0.4593
10320	0.0226	.....	10920	2.3865	2.0864	11520	0.5102	0.8739	12120	0.0652	0.4498
10330	0.0230	.....	10930	2.4244	2.1202	11530	0.4987	0.8731	12130	0.0557	0.4403
10340	0.0234	.....	10940	2.4623	2.1540	11540	0.4872	0.8723	12140	0.0462	0.4308
10350	0.0238	.....	10950	2.4999	2.1878	11550	0.4757	0.8715	12150	0.0367	0.4213

ORIGIN OF
OF POOR QUALITY

Table A7c
(CONTINUED)

WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F	WAVELENGTH (nm)	PF	F
12150	0.1728	0.8907	12380	0.0817	0.5991	12600	0.0038	0.0422	12870	0.0005	0.0076
12170	0.1707	0.8891	12390	0.0757	0.5721	12610	0.0036	0.0400	12870	0.0005	0.0076
12180	0.1685	0.8875	12400	0.0699	0.5451	12620	0.0033	0.0377	12870	0.0005	0.0076
12190	0.1663	0.8859	12410	0.0646	0.5149	12630	0.0031	0.0356	12870	0.0005	0.0076
12200	0.1636	0.8843	12420	0.0595	0.4846	12640	0.0028	0.0334	12870	0.0005	0.0076
12210	0.1606	0.8814	12430	0.0544	0.4543	12650	0.0026	0.0312	12870	0.0005	0.0076
12220	0.1575	0.8786	12440	0.0494	0.4238	12660	0.0024	0.0291	12870	0.0005	0.0076
12230	0.1544	0.8758	12450	0.0446	0.3934	12670	0.0022	0.0270	12870	0.0005	0.0076
12240	0.1514	0.8731	12460	0.0399	0.3628	12680	0.0020	0.0248	12870	0.0005	0.0076
12250	0.1483	0.8703	12470	0.0355	0.3322	12690	0.0018	0.0228	12870	0.0005	0.0076
12260	0.1453	0.8675	12480	0.0312	0.3015	12700	0.0016	0.0207	12870	0.0005	0.0076
12270	0.1422	0.8648	12490	0.0272	0.2708	12710	0.0015	0.0184	12870	0.0005	0.0076
12280	0.1393	0.8621	12500	0.0233	0.2400	12720	0.0014	0.0162	12870	0.0005	0.0076
12290	0.1373	0.8601	12510	0.0211	0.2197	12730	0.0013	0.0140	12870	0.0005	0.0076
12300	0.1271	0.8166	12520	0.0189	0.1996	12740	0.0012	0.0117	12870	0.0005	0.0076
12310	0.1222	0.7893	12530	0.0168	0.1795	12750	0.0011	0.0095	12870	0.0005	0.0076
12320	0.1170	0.7620	12540	0.0147	0.1596	12760	0.0010	0.0073	12870	0.0005	0.0076
12330	0.1119	0.7347	12550	0.0127	0.1397	12770	0.0009	0.0051	12870	0.0005	0.0076
12340	0.1069	0.7075	12560	0.0107	0.1200	12780	0.0008	0.0029	12870	0.0005	0.0076
12350	0.1012	0.6803	12570	0.0087	0.1004	12790	0.0007	0.0007	12870	0.0005	0.0076
12360	0.0945	0.6532	12580	0.0068	0.0808	12800	0.0006	0.0005	12870	0.0005	0.0076
12370	0.0880	0.6261	12590	0.0053	0.0614	12810	0.0005	0.0005	12870	0.0005	0.0076

Table A7d

THEMATIC MAPPER RELATIVE SPECTRAL RESPONSE - BAND 6 *** DETECTOR 4

WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F	WAVELENGTH (NM)	PF	F
10000	0.0034	0.0058	10600	0.8375	0.7779	11200	0.8728	0.9552	11800	0.4297	0.9773
10010	0.0037	0.0066	10610	0.8411	0.7793	11210	0.8682	0.9579	11810	0.4215	0.9778
10020	0.0103	0.0073	10620	0.8447	0.7806	11220	0.8637	0.9608	11820	0.4133	0.9782
10030	0.0107	0.0081	10630	0.8483	0.7820	11230	0.8591	0.9635	11830	0.4050	0.9787
10040	0.0110	0.0088	10640	0.8516	0.7833	11240	0.8552	0.9661	11840	0.3958	0.9792
10050	0.0113	0.0096	10650	0.8559	0.7846	11250	0.8524	0.9688	11850	0.3859	0.9797
10060	0.0116	0.0104	10660	0.8599	0.7859	11260	0.8496	0.9716	11860	0.3761	0.9801
10070	0.0119	0.0112	10670	0.8600	0.7872	11270	0.8468	0.9743	11870	0.3659	0.9806
10080	0.0122	0.0120	10680	0.8620	0.7884	11280	0.8439	0.9771	11880	0.3557	0.9810
10090	0.0126	0.0128	10690	0.8647	0.7896	11290	0.8410	0.9798	11890	0.3455	0.9815
10100	0.0136	0.0136	10700	0.8670	0.7908	11300	0.8352	0.9826	11900	0.3357	0.9819
10110	0.0142	0.0150	10710	0.8694	0.7958	11310	0.8294	0.9832	11910	0.3274	0.9816
10120	0.0159	0.0165	10720	0.8742	0.8008	11320	0.8266	0.9838	11920	0.3190	0.9813
10130	0.0177	0.0188	10730	0.8786	0.8058	11330	0.8232	0.9844	11930	0.3109	0.9809
10140	0.0194	0.0195	10740	0.8820	0.8108	11340	0.8197	0.9849	11940	0.3030	0.9805
10150	0.0212	0.0210	10750	0.8875	0.8158	11350	0.8162	0.9855	11950	0.2953	0.9801
10160	0.0230	0.0226	10760	0.8919	0.8209	11360	0.8126	0.9860	11960	0.2876	0.9797
10170	0.0249	0.0241	10770	0.8964	0.8260	11370	0.8075	0.9866	11970	0.2799	0.9793
10180	0.0267	0.0256	10780	0.9029	0.8311	11380	0.8017	0.9871	11980	0.2722	0.9788
10190	0.0286	0.0288	10790	0.9115	0.8362	11390	0.7971	0.9876	11990	0.2639	0.9784
10200	0.0305	0.0305	10800	0.9202	0.8413	11400	0.7925	0.9881	12000	0.2556	0.9779
10210	0.0337	0.0334	10810	0.9285	0.8479	11410	0.7884	0.9893	12010	0.2524	0.9769
10220	0.0371	0.0381	10820	0.9342	0.8544	11420	0.7889	0.9905	12020	0.2484	0.9759
10230	0.0431	0.0428	10830	0.9398	0.8610	11430	0.7884	0.9917	12030	0.2444	0.9749
10240	0.0506	0.0476	10840	0.9455	0.8677	11440	0.7875	0.9929	12040	0.2404	0.9739
10250	0.0607	0.0524	10850	0.9512	0.8743	11450	0.7865	0.9941	12050	0.2335	0.9729
10260	0.0733	0.0572	10860	0.9569	0.8810	11460	0.7834	0.9953	12060	0.2326	0.9719
10270	0.0888	0.0621	10870	0.9625	0.8877	11470	0.784	0.9965	12070	0.2287	0.9708
10280	0.0967	0.0670	10880	0.9654	0.8945	11480	0.7733	0.9977	12080	0.2248	0.9698
10290	0.1046	0.0719	10890	0.9682	0.9013	11490	0.7683	0.9989	12090	0.2210	0.9688
10300	0.1141	0.0769	10900	0.9711	0.9081	11500	0.7622	1.0000	12100	0.2172	0.9677
10310	0.1256	0.0811	10910	0.9752	0.9146	11510	0.7521	0.9920	12110	0.2126	0.9665
10320	0.1459	0.1256	10920	0.9793	0.9212	11520	0.7428	0.9840	12120	0.2080	0.9653
10330	0.1780	0.1502	10930	0.9832	0.9278	11530	0.7322	0.9761	12130	0.2026	0.9640
10340	0.2103	0.1751	10940	0.9854	0.9345	11540	0.7223	0.9682	12140	0.1971	0.9627
10350	0.2428	0.2002	10950	0.9876	0.9412	11550	0.7126	0.9603	12150	0.1915	0.9615
10360	0.2755	0.2256	10960	0.9898	0.9479	11560	0.7029	0.9524	12160	0.1859	0.9602
10370	0.3085	0.2511	10970	0.9921	0.9547	11570	0.6951	0.9446	12170	0.1803	0.9589
10380	0.3417	0.2769	10980	0.9943	0.9614	11580	0.6875	0.9368	12180	0.1747	0.9577
10390	0.3752	0.3029	10990	0.9965	0.9683	11590	0.6799	0.9290	12190	0.1690	0.9564
10400	0.4095	0.3292	11000	0.9988	0.9751	11600	0.6743	0.9213	12200	0.1629	0.9551
10410	0.4438	0.3633	11010	0.9990	0.9759	11610	0.6592	0.9133	12210	0.1591	0.9481
10420	0.4815	0.3974	11020	0.9992	0.9768	11620	0.6442	0.9272	12220	0.1554	0.9412
10430	0.5262	0.4317	11030	0.9995	0.9776	11630	0.6306	0.9362	12230	0.1517	0.9343
10440	0.5713	0.4661	11040	0.9997	0.9784	11640	0.6188	0.9332	12240	0.1479	0.9274
10450	0.6168	0.5005	11050	1.0000	0.9793	11650	0.6070	0.9361	12250	0.1442	0.9205
10460	0.6629	0.5350	11060	0.9968	0.9801	11660	0.5951	0.9391	12260	0.1405	0.9136
10470	0.7093	0.5696	11070	0.9936	0.9809	11670	0.5831	0.9420	12270	0.1368	0.9067
10480	0.7565	0.6043	11080	0.9903	0.9818	11680	0.5711	0.9450	12280	0.1333	0.8999
10490	0.7988	0.6391	11090	0.9855	0.9828	11690	0.5579	0.9480	12290	0.1256	0.8930
10500	0.8417	0.6739	11100	0.9807	0.9834	11700	0.5454	0.9509	12300	0.1201	0.8861
10510	0.8847	0.7083	11110	0.9739	0.9806	11710	0.5358	0.9536	12310	0.1156	0.8788
10520	0.9278	0.7432	11120	0.9625	0.9778	11720	0.5241	0.9562	12320	0.1107	0.8725
10530	0.9707	0.7782	11130	0.9510	0.9750	11730	0.5124	0.9589	12330	0.1059	0.8658
10540	0.8398	0.7145	11140	0.9396	0.9721	11740	0.5008	0.9615	12340	0.1013	0.8593
10550	0.8439	0.7248	11150	0.9283	0.9633	11750	0.4891	0.9642	12350	0.0960	0.8528
10560	0.8458	0.7353	11160	0.9170	0.9655	11760	0.4775	0.9668	12360	0.0897	0.8461
10570	0.8461	0.7458	11170	0.9059	0.9677	11770	0.4656	0.9694	12370	0.0836	0.8394
10580	0.8464	0.7564	11180	0.8948	0.9608	11780	0.4536	0.9721	12380	0.0778	0.8323
10590	0.8435	0.7671	11190	0.8837	0.9580	11790	0.4417	0.9747	12390	0.0721	0.8252

ORIGINAL FILE IS
OF POOR QUALITY

Table A7d
(CONTINUED)[illegible]